

## Preaward Compliance Review Report for All Applicants and Recipients Requesting EPA Financial Assistance

Note: Read Instructions before completing form.

### I. A. Applicant/Recipient (Name, Address, City, State, Zip Code)

Name:

Address:

City:

State:  Zip Code:

B. DUNS No.

II. Is the applicant currently receiving EPA Assistance? ☒ Yes ☐ No

III. List all civil rights lawsuits and administrative complaints pending against the applicant/recipient that allege discrimination based on race, color, national origin, sex, age, or disability. (Do not include employment complaints not covered by 40 C.F.R. Parts 5 and 7.)

Department	Case Name	
Case Number	Type of Case	
PCSD	Bonillas, Laura v. Pima County Sherriff's Dept.	
CRD-2021-1003	Arizona Civil Rights Division (ACRD)--Religious	
PCSD	Felix, Christian v. Pima County Sherriff's Dept.	
CRD-2021-1065	ACRD-- Religious	
Finance	McGee, Patrick v. Pima County Finance and Risk Mgmt.	520-2021-03753
EEOC--Religious		
PD	Schuster, Deborah v. Pima County Public Fiduciary	CRD-2022-0075
ACRD--Religious		
CWD	Carreras, Sol v. Pima County Comm. & Workforce Dev.	CRD-2022-0146
ACRD--Religious		
PACC	Stella, Cynthia v. Pima Animal Care Center	
C20214483	Superior Court, disability, gender identity, sexual orientation, age and	
retaliation		
IT	Brooks, Kristina v. Pima County	
520-2018-04212	Federal--Gender	
Health	Whiting, Danna v. Pima County Board of Supervisors et al	4:19-cv-00249-TUC-
JCH Federal--Disability		
DOT	Fermawi, Ali v. Pima County Dept. of Transportation	
35A-2019-00269C	EEOC--National Origin and Age	
County	Nelson, Bradley v. Pima County	
4:21-cv-00455-JCH	Federal--Age, Disability and Retaliation	

IV. List all civil rights lawsuits and administrative complaints decided against the applicant/recipient within the last year that allege discrimination based on race, color, national origin, sex, age, or disability and enclose a copy of all decisions. Please describe all corrective actions taken. (Do not include employment complaints not covered by 40 C.F.R. Parts 5 and 7.)

None

V. List all civil rights compliance reviews of the applicant/recipient conducted by any agency within the last two years and enclose a copy of the review and any decisions, orders, or agreements based on the review. Please describe any corrective action taken. (40 C.F.R. § 7.80(c)(3))

None

VI. Is the applicant requesting EPA assistance for new construction? If no, proceed to VII; if yes, answer (a) and/or (b) below.

☐ Yes ☒ No

a. If the grant is for new construction, will all new facilities or alterations to existing facilities be designed and constructed to be readily accessible to and usable by persons with disabilities? If yes, proceed to VII; if no, proceed to VI(b).

☐ Yes ☐ No

b. If the grant is for new construction and the new facilities or alterations to existing facilities will not be readily accessible to and usable by persons with disabilities, explain how a regulatory exception (40 C.F.R. 7.70) applies.

- VII. Does the applicant/recipient provide initial and continuing notice that it does not discriminate on the basis of race, color, national origin, sex, age, or disability in its program or activities? (40 C.F.R. 5.140 and 7.95) ☒ Yes ☐ No
- a. Do the methods of notice accommodate those with impaired vision or hearing? ☒ Yes ☐ No
- b. Is the notice posted in a prominent place in the applicant's offices or facilities or, for education programs and activities, in appropriate periodicals and other written communications? ☒ Yes ☐ No
- c. Does the notice identify a designated civil rights coordinator? ☒ Yes ☐ No
- VIII. Does the applicant/recipient maintain demographic data on the race, color, national origin, sex, age, or handicap of the population it serves? (40 C.F.R. 7.85(a)) ☒ Yes ☐ No
- IX. Does the applicant/recipient have a policy/procedure for providing access to services for persons with limited English proficiency? (40 C.F.R. Part 7, E.O. 13166) ☒ Yes ☐ No
- X. If the applicant is an education program or activity, or has 15 or more employees, has it designated an employee to coordinate its compliance with 40 C.F.R. Parts 5 and 7? Provide the name, title, position, mailing address, e-mail address, fax number, and telephone number of the designated coordinator.

For environmental justice complaints: Natalie Shepp, Senior Program Manager, PDEQ, 33 N. Stone Ave., Suite 700, Tucson AZ 85701; telephone: 520-724-6885; natalie.shepp@pima.gov  
For employment rights compliance: Octavio Barcelo, Employment Rights Coordinator, HR Supervisor, 150 W. Congress, St., 4th Floor, Tucson, AZ 85701; telephone 520-724-2782; octavio.barcelo@pima.gov

- XI. If the applicant is an education program or activity, or has 15 or more employees, has it adopted grievance procedures that assure the prompt and fair resolution of complaints that allege a violation of 40 C.F.R. Parts 5 and 7? Provide a legal citation or Internet Address for, or a copy of, the procedures.

Pima County Department of Environmental Quality procedure: [https://webcms.pima.gov/UserFiles/Servers/Server\\_6/File/Government/Environmental%20Quality/InforEdOutreach/EnvironmentalJustice/AZ-201EnvJusticeGrievanceProcedure.pdf](https://webcms.pima.gov/UserFiles/Servers/Server_6/File/Government/Environmental%20Quality/InforEdOutreach/EnvironmentalJustice/AZ-201EnvJusticeGrievanceProcedure.pdf)  
Pima County Equal Opportunity Plan: [https://webcms.pima.gov/UserFiles/Servers/Server\\_6/File/Government/Human%20Resources/EEOP/EEOP%20Utilization%20Report%202019%20-%20Pima%20County.pdf](https://webcms.pima.gov/UserFiles/Servers/Server_6/File/Government/Human%20Resources/EEOP/EEOP%20Utilization%20Report%202019%20-%20Pima%20County.pdf)

#### For the Applicant/Recipient

I certify that the statements I have made on this form and all attachments thereto are true, accurate and complete. I acknowledge that any knowingly false or misleading statement may be punishable by fine or imprisonment or both under applicable law. I assure that I will fully comply with all applicable civil rights statutes and EPA regulations.

A. Signature of Authorized Official

Dorothee Harmon

B. Title of Authorized Official

Division Manager

C. Date

03/25/2022

#### For the U.S. Environmental Protection Agency

I have reviewed the information provided by the applicant/recipient and hereby certify that the applicant/recipient has submitted all preaward compliance information required by 40 C.F.R. Parts 5 and 7; that based on the information submitted, this application satisfies the preaward provisions of 40 C.F.R. Parts 5 and 7; and that the applicant has given assurance that it will fully comply with all applicable civil rights statutes and EPA regulations.

A. \*Signature of Authorized EPA Official

B. Title of Authorized Official

C. Date

**\* See Instructions**

Instructions for EPA FORM 4700-4 (Rev. 06/2014)

General. Recipients of Federal financial assistance from the U.S. Environmental Protection Agency must comply with the following statutes and regulations.

Title VI of the Civil Rights Acts of 1964 provides that no person in the United States shall, on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance. The Act goes on to explain that the statute shall not be construed to authorize action with respect to any employment practice of any employer, employment agency, or labor organization (except where the primary objective of the Federal financial assistance is to provide employment). Section 13 of the 1972 Amendments to the Federal Water Pollution Control Act provides that no person in the United States shall on the ground of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under the Federal Water Pollution Control Act, as amended. Employment discrimination on the basis of sex is prohibited in all such programs or activities. Section 504 of the Rehabilitation Act of 1973 provides that no otherwise qualified individual with a disability in the United States shall solely by reason of disability be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance. Employment discrimination on the basis of disability is prohibited in all such programs or activities. The Age Discrimination Act of 1975 provides that no person on the basis of age shall be excluded from participation under any program or activity receiving Federal financial assistance. Employment discrimination is not covered. Age discrimination in employment is prohibited by the Age Discrimination in Employment Act administered by the Equal Employment Opportunity Commission. Title IX of the Education Amendments of 1972 provides that no person in the United States on the basis of sex shall be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance. Employment discrimination on the basis of sex is prohibited in all such education programs or activities. Note: an education program or activity is not limited to only those conducted by a formal institution. 40 C.F.R. Part 5 implements Title IX of the Education Amendments of 1972. 40 C.F.R. Part 7 implements Title VI of the Civil Rights Act of 1964, Section 13 of the 1972 Amendments to the Federal Water Pollution Control Act, and Section 504 of The Rehabilitation Act of 1973. The Executive Order 13166 (E.O. 13166) entitled; "Improving Access to Services for Persons with Limited English Proficiency" requires Federal agencies work to ensure that recipients of Federal financial assistance provide meaningful access to their LEP applicants and beneficiaries.

Items "Applicant" means any entity that files an application or unsolicited proposal or otherwise requests EPA assistance. 40 C.F.R. §§ 5.105, 7.25. "Recipient" means any entity, other than applicant, which will actually receive EPA assistance. 40 C.F.R. §§ 5.105, 7.25. "Civil rights lawsuits and administrative complaints" means any lawsuit or administrative complaint alleging discrimination on the basis of race, color, national origin, sex, age, or disability pending or decided against the applicant and/or entity which actually benefits from the grant, but excluding employment complaints not covered by 40 C.F.R. Parts 5 and 7. For example, if a city is the named applicant but the grant will actually benefit the Department of Sewage, civil rights lawsuits involving both the city and the Department of Sewage should be listed. "Civil rights compliance review" means any review assessing the applicant's and/or recipient's compliance with laws prohibiting discrimination on the basis of race, color, national origin, sex, age, or disability. Submit this form with the original and required copies of applications, requests for extensions, requests for increase of funds, etc. Updates of information are all that are required after the initial application submission. If any item is not relevant to the project for which assistance is requested, write "NA" for "Not Applicable." In the event applicant is uncertain about how to answer any questions, EPA program officials should be contacted for clarification. \* Note: Signature appears in the Approval Section of the EPA Comprehensive Administrative Review For Grants/Cooperative Agreements & Continuation/Supplemental Awards form.



# EPA KEY CONTACTS FORM

OMB Number: 2030-0020  
Expiration Date: 06/30/2024

**Authorized Representative:** *Original awards and amendments will be sent to this individual for review and acceptance, unless otherwise indicated.*

<b>Name:</b>	<b>Prefix:</b>	<input type="text"/>	<b>First Name:</b>	<input type="text" value="Dorothee"/>	<b>Middle Name:</b>	<input type="text"/>
	<b>Last Name:</b>	<input type="text" value="Harmon"/>			<b>Suffix:</b>	<input type="text"/>
<b>Title:</b>	<input type="text"/>					
<b>Complete Address:</b>						
<b>Street1:</b>	<input type="text" value="130 W. Congress"/>					
<b>Street2:</b>	<input type="text" value="6th Floor"/>					
<b>City:</b>	<input type="text" value="Tucson"/>	<b>State:</b>	<input type="text" value="AZ: Arizona"/>			
<b>Zip / Postal Code:</b>	<input type="text" value="85701"/>	<b>Country:</b>	<input type="text" value="USA: UNITED STATES"/>			
<b>Phone Number:</b>	<input type="text" value="520-724-6760"/>			<b>Fax Number:</b>	<input type="text"/>	
<b>E-mail Address:</b>	<input type="text"/>					

**Payee:** *Individual authorized to accept payments.*

<b>Name:</b>	<b>Prefix:</b>	<input type="text"/>	<b>First Name:</b>	<input type="text" value="Maggie"/>	<b>Middle Name:</b>	<input type="text"/>
	<b>Last Name:</b>	<input type="text" value="Crowdes"/>			<b>Suffix:</b>	<input type="text"/>
<b>Title:</b>	<input type="text"/>					
<b>Complete Address:</b>						
<b>Street1:</b>	<input type="text" value="130 W. Congress St."/>					
<b>Street2:</b>	<input type="text" value="4th Floor"/>					
<b>City:</b>	<input type="text" value="Tucson"/>	<b>State:</b>	<input type="text" value="AZ: Arizona"/>			
<b>Zip / Postal Code:</b>	<input type="text" value="85701-1317"/>	<b>Country:</b>	<input type="text" value="USA: UNITED STATES"/>			
<b>Phone Number:</b>	<input type="text" value="520-724-7949"/>			<b>Fax Number:</b>	<input type="text"/>	
<b>E-mail Address:</b>	<input type="text"/>					

**Administrative Contact:** *Individual from Sponsored Programs Office to contact concerning administrative matters (i.e., indirect cost rate computation, rebudgeting requests etc).*

<b>Name:</b>	<b>Prefix:</b>	<input type="text"/>	<b>First Name:</b>	<input type="text" value="Rebecca"/>	<b>Middle Name:</b>	<input type="text"/>
	<b>Last Name:</b>	<input type="text" value="Potter"/>			<b>Suffix:</b>	<input type="text"/>
<b>Title:</b>	<input type="text"/>					
<b>Complete Address:</b>						
<b>Street1:</b>	<input type="text" value="130 W. Congress"/>					
<b>Street2:</b>	<input type="text" value="4th Floor"/>					
<b>City:</b>	<input type="text" value="Tucson"/>	<b>State:</b>	<input type="text" value="AZ: Arizona"/>			
<b>Zip / Postal Code:</b>	<input type="text" value="85701-1317"/>	<b>Country:</b>	<input type="text" value="USA: UNITED STATES"/>			
<b>Phone Number:</b>	<input type="text" value="520-724-7774"/>			<b>Fax Number:</b>	<input type="text"/>	
<b>E-mail Address:</b>	<input type="text"/>					

# EPA KEY CONTACTS FORM

**Project Manager:** *Individual responsible for the technical completion of the proposed work.*

**Name:** **Prefix:**  **First Name:**  **Middle Name:**

**Last Name:**  **Suffix:**

**Title:**

**Complete Address:**

**Street1:**

**Street2:**

**City:**

**State:**

**Zip / Postal Code:**

**Country:**

**Phone Number:**

**Fax Number:**

**E-mail Address:**

## Application for Federal Assistance SF-424

\* 1. Type of Submission:

- ☐ Preapplication  
☒ Application  
☐ Changed/Corrected Application

\* 2. Type of Application:

- ☒ New  
☐ Continuation  
☐ Revision

\* If Revision, select appropriate letter(s):

\* Other (Specify):

\* 3. Date Received:

03/25/2022

4. Applicant Identifier:

5a. Federal Entity Identifier:

5b. Federal Award Identifier:

### State Use Only:

6. Date Received by State:

7. State Application Identifier:

### 8. APPLICANT INFORMATION:

\* a. Legal Name:

Pima County

\* b. Employer/Taxpayer Identification Number (EIN/TIN):

86-6000543

\* c. Organizational DUNS:

0744779690000

### d. Address:

\* Street1:

130 W. Congress

Street2:

6th Floor

\* City:

Tucson

County/Parish:

Choose State...

\* State:

AZ: Arizona

Province:

\* Country:

USA: UNITED STATES

\* Zip / Postal Code:

85701-1317

### e. Organizational Unit:

Department Name:

Division Name:

### f. Name and contact information of person to be contacted on matters involving this application:

Prefix:

\* First Name:

Natalie

Middle Name:

\* Last Name:

Shepp

Suffix:

Title:

Organizational Affiliation:

Pima County

\* Telephone Number:

520-724-6885

Fax Number:

\* Email:

natalie.shepp@pima.gov

## Application for Federal Assistance SF-424

### \* 9. Type of Applicant 1: Select Applicant Type:

B: County Government

Type of Applicant 2: Select Applicant Type:

Type of Applicant 3: Select Applicant Type:

\* Other (specify):

### \* 10. Name of Federal Agency:

Environmental Protection Agency

### 11. Catalog of Federal Domestic Assistance Number:

66.034

CFDA Title:

Surveys, Studies, Research, Investigations, Demonstrations, and Special Purpose Activities  
Relating to the Clean Air Act

### \* 12. Funding Opportunity Number:

EPA-OAR-OAQPS-22-01

\* Title:

Enhanced Air Quality Monitoring for Communities

### 13. Competition Identification Number:

Title:

### 14. Areas Affected by Project (Cities, Counties, States, etc.):

1238-AreasAffectedPimaCounty.pdf

Add Attachment

Delete Attachment

View Attachment

### \* 15. Descriptive Title of Applicant's Project:

Expanding Localized Air Quality Monitoring at Pima County Schools to Address Environmental Justice

Attach supporting documents as specified in agency instructions.

Add Attachments

Delete Attachments

View Attachments

**Application for Federal Assistance SF-424****16. Congressional Districts Of:**

\* a. Applicant

03

\* b. Program/Project

03

Attach an additional list of Program/Project Congressional Districts if needed.

1239-CongressionalDistrictsPimaCounty.pdf

Add Attachment

Delete Attachment

View Attachment

**17. Proposed Project:**

\* a. Start Date:

07/01/2022

\* b. End Date:

06/30/2025

**18. Estimated Funding (\$):**

\* a. Federal

488,210.33

\* b. Applicant

0.00

\* c. State

0.00

\* d. Local

0.00

\* e. Other

0.00

\* f. Program Income

0.00

\* g. TOTAL

488,210.33

**\* 19. Is Application Subject to Review By State Under Executive Order 12372 Process?**☐ a. This application was made available to the State under the Executive Order 12372 Process for review on☒ b. Program is subject to E.O. 12372 but has not been selected by the State for review.☐ c. Program is not covered by E.O. 12372.**\* 20. Is the Applicant Delinquent On Any Federal Debt? (If "Yes," provide explanation in attachment.)**☐ Yes☒ No

If "Yes", provide explanation and attach

Add Attachment

Delete Attachment

View Attachment

**21. \*By signing this application, I certify (1) to the statements contained in the list of certifications\*\* and (2) that the statements herein are true, complete and accurate to the best of my knowledge. I also provide the required assurances\*\* and agree to comply with any resulting terms if I accept an award. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties. (U.S. Code, Title 218, Section 1001)**

☒ \*\* I AGREE

\*\* The list of certifications and assurances, or an internet site where you may obtain this list, is contained in the announcement or agency specific instructions.

**Authorized Representative:**

Prefix:

\* First Name:

Dorothee

Middle Name:

\* Last Name:

Harmon

Suffix:

\* Title:

Division Manager

\* Telephone Number:

520-724-6760

Fax Number:

\* Email:

dorothee.harmon@pima.gov

\* Signature of Authorized Representative:

Dorothee Harmon

\* Date Signed:

03/25/2022



## Project Narrative File(s)

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\* Mandatory Project Narrative File Filename:

Add Mandatory Project Narrative File

Delete Mandatory Project Narrative File

View Mandatory Project Narrative File

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To add more Project Narrative File attachments, please use the attachment buttons below.

Add Optional Project Narrative File

Delete Optional Project Narrative File

View Optional Project Narrative File

# BUDGET INFORMATION - Non-Construction Programs

OMB Number: 4040-0006  
Expiration Date: 02/28/2022

## SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. Enhanced Air Quality Monitoring for Communities	66.034	\$	\$	\$ 488,210.33	\$ 0.00	\$ 488,210.33
2.						
3.						
4.						
5. Totals		\$	\$	\$ 488,210.33	\$ 0.00	\$ 488,210.33

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# SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total (5)
	(1)	(2)	(3)	(4)	
	Enhanced Air Quality Monitoring for Communities				
a. Personnel	\$ 64,715.04	\$	\$	\$	\$ 64,715.04
b. Fringe Benefits	23,944.56				23,944.56
c. Travel	3,000.00				3,000.00
d. Equipment	0.00				0.00
e. Supplies	140,500.00				140,500.00
f. Contractual	0.00				0.00
g. Construction	0.00				0.00
h. Other	230,334.77				230,334.77
i. Total Direct Charges (sum of 6a-6h)	462,494.37				\$ 462,494.37
j. Indirect Charges	25,715.96				\$ 25,715.96
k. TOTALS (sum of 6i and 6j)	\$ 488,210.33	\$	\$	\$	\$ 488,210.33
7. Program Income	\$	\$	\$	\$	\$

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SECTION C - NON-FEDERAL RESOURCES					
(a) Grant Program		(b) Applicant	(c) State	(d) Other Sources	(e)TOTALS
8.	Enhanced Air Quality Monitoring for Communities	\$ 0.00	\$	\$	\$ 0.00
9.					
10.					
11.					
12. TOTAL (sum of lines 8-11)		\$ 0.00	\$	\$	\$ 0.00

SECTION D - FORECASTED CASH NEEDS					
	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	\$ 260,782.75	\$ 170,570.69	\$ 30,070.69	\$ 30,070.69	\$ 30,070.68
14. Non-Federal	\$				
15. TOTAL (sum of lines 13 and 14)	\$ 260,782.75	\$ 170,570.69	\$ 30,070.69	\$ 30,070.69	\$ 30,070.68

SECTION E - BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT					
(a) Grant Program		FUTURE FUNDING PERIODS (YEARS)			
		(b)First	(c) Second	(d) Third	(e) Fourth
16.	Enhanced Air Quality Monitoring for Communities	\$ 113,713.79	\$ 113,713.79	\$	\$
17.					
18.					
19.					
20. TOTAL (sum of lines 16 - 19)		\$ 113,713.79	\$ 113,713.79	\$	\$

SECTION F - OTHER BUDGET INFORMATION	
21. Direct Charges: 462,494.37	22. Indirect Charges: \$25,715.96
23. Remarks:	

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## Quality Assurance Statement

Project Title: Expanding Localized Air Quality Monitoring at Pima County Schools to Address Environmental Justice

Background and Project Description: This project will install 30 MODULAIR instruments capable of measuring PM<sub>1</sub>, PM<sub>2.5</sub>, PM<sub>10</sub>, NO<sub>2</sub>, O<sub>3</sub>, and CO at schools across Pima County, Arizona. The MODULAIR units, after collocation and installation at schools, will run continuously during (and after) the course of the study. The 1-min data from these instruments will be uploaded in real-time to the cloud. We will construct spatiotemporal prediction models and an online data platform to share measurement data with the public.

Data Quality Objectives and Indicators: Prior to deployment at schools, we will co-locate 30 MODULAIR units at the Children's Park site which has PM and multiple gas (NO<sub>2</sub>, O<sub>3</sub>, and CO) regulatory monitors running. We will conduct collocation for two months and examine 1) between-unit variability; 2) agreements between the regulatory monitor and MODULAIR measurements; and 3) the potential impact of relative humidity and temperature on measurements. To adjust for deviations between the units and/or differences against the regulatory monitor, we will fit statistical models to adjust for such differences. Specifically, the MODULAIR readings will be the independent variable and regulatory monitor readings will be the dependent variable. The regression models will additionally explore the impact of adding humidity and temperature. Raw vs. calibrated MODULAIR measurements will be compared via by R<sup>2</sup> values and root mean squared errors (RMSE). We will aim to have MODULAIR instruments within 20% of regulatory monitor readings, and 10% differences between each instrument using the calibration. Given the potential for sensor decay or drift, we will again co-locate the sensors at the midpoint in year 2 and end of the study periods (for two weeks each) for verification and to examine whether calibration curves are still adequate. The calculations on bias, precision, accuracy, and data completeness during the initial collocation session will be prepared as a short report to be shared on the online data portal. The collected data from co-locations will be shared and discussed between Pima Department of Environmental Quality and UofA researchers prior to report preparation.

Previous works have found that QA/QC processes can add significant costs to low-cost sensor projects that dwarf instrument costs. The repeated removal and re-installation of sensors needed for more frequent collocation at regulatory sites are therefore likely to be difficult, especially since they are installed at many schools spread over Pima County. During the course of the study, we will therefore employ a 'mobile calibration' approach to minimize costs associated with QA/QC and disruption to schools. We will use the University of Arizona's (UofA) multiple Aeroqual S500 units with available PM, NO<sub>2</sub>, CO, O<sub>3</sub> sensor heads. In this approach, we will first co-locate the multiple Aeroqual monitors to regulatory monitors for a set time (1 week) prior to each mobile calibration session. Then we will co-locate and operate the Aeroqual to compare readings against Modulair for each school location (2 days). Although not as comprehensive as collocation at regulatory monitors, this will allow us to detect significant problems and sensor drift. If sensor drift is detected, then we will re-do collocation at regulatory sites to construct a new calibration curve.

Project Schedule: We will conduct mobile calibration every 4 months in non-summer seasons, and every 2 months during the summers, especially as high heat could accelerate sensor deterioration. PDEQ will lead collocation and mobile calibration, while UArizona will help interpret the data and construct the calibration curves. We will also review the collected data during the monthly data preparation (details below) to detect sensor decay or drift (e.g., wildly fluctuation measurements or constant zeros). If sensor or equipment failure is identified, then the sensor will be flagged on the online portal. We will attempt on-site repairs within 5 business days, and we will contact the vendor if replacement of internal sensors is needed. Previously collected data by the flagged instrument will also be reviewed. We will have monthly meetings to discuss data and sensor failures, and on updating the QA/QC methods as necessary.

Data Management and Review: Collected raw data will be automatically uploaded to the secure QuantAQ cloud and stored. Then from the QuantAQ Cloud, the data will be pulled via the API (application programming interface) and streamed near real-time to our online data portal that will be constructed as part of this project. The real-time data will show adjusted readings using calibration curves developed from the initial collocation. Downloadable data (in csv format) of the previous month will be prepared and shared during the second week

of every month after ongoing quality control. During quality control, we will flag potential outliers and remove erroneous measurements (e.g., negative values). Data download will include several different temporal aggregations as controlled by the user interface (e.g., 1-min average, 10-minute average, 1-hr average, and 24-hour average) along with time, relative humidity, and temperature data. Both raw and calibrated data will be available. At least 45 min of valid data will be required to calculate an hourly average (i.e., 75% data completeness). Data management and review will be led by Dr. Chris Lim.

Manifest for Grant Application # GRANT13580073

Grant Application XML file (total 1):

1. GrantApplication.xml. (size 29635 bytes)

Forms Included in Zip File(total 6):

1. Form ProjectNarrativeAttachments\_1\_2-V1.2.pdf (size 16114 bytes)

2. Form SF424\_3\_0-V3.0.pdf (size 24095 bytes)

3. Form SF424A-V1.0.pdf (size 22929 bytes)

4. Form EPA4700\_4\_3\_0-V3.0.pdf (size 23824 bytes)

5. Form OtherNarrativeAttachments\_1\_2-V1.2.pdf (size 15904 bytes)

6. Form EPA\_KeyContacts\_2\_0-V2.0.pdf (size 37131 bytes)

Attachments Included in Zip File (total 10):

1. OtherNarrativeAttachments\_1\_2 OtherNarrativeAttachments\_1\_2-Attachments-1237-Letters of Support (Combined).pdf application/pdf (size 5817308 bytes)

2. OtherNarrativeAttachments\_1\_2 OtherNarrativeAttachments\_1\_2-Attachments-1235-QA statement.pdf application/pdf (size 120383 bytes)

3. SF424\_3\_0 SF424\_3\_0-1239-CongressionalDistrictsPimaCounty.pdf application/pdf (size 217894 bytes)

4. OtherNarrativeAttachments\_1\_2 OtherNarrativeAttachments\_1\_2-Attachments-1236-Resumes (Combined).pdf application/pdf (size 371747 bytes)

5. OtherNarrativeAttachments\_1\_2 OtherNarrativeAttachments\_1\_2-Attachments-1234-Final Project Narrative.pdf application/pdf (size 548101 bytes)

6. SF424\_3\_0 SF424\_3\_0-1238-AreasAffectedPimaCounty.pdf application/pdf (size 230660 bytes)

7. ProjectNarrativeAttachments\_1\_2 ProjectNarrativeAttachments\_1\_2-Attachments-1242-Resumes (Combined).pdf application/pdf (size 371747 bytes)

8. ProjectNarrativeAttachments\_1\_2 ProjectNarrativeAttachments\_1\_2-Attachments-1241-QA statement.pdf application/pdf (size 125052 bytes)

9. ProjectNarrativeAttachments\_1\_2 ProjectNarrativeAttachments\_1\_2-Attachments-1243-Letters of Support (Combined).pdf application/pdf (size 5817308 bytes)

10. ProjectNarrativeAttachments\_1\_2 ProjectNarrativeAttachments\_1\_2-Attachments-1240-Final Project Narrative.pdf application/pdf (size 548101 bytes)

## Quality Assurance Statement

Project Title: Expanding Localized Air Quality Monitoring at Pima County Schools to Address Environmental Justice.

Background and Project Description: This project will install 30 MODULAIR monitors ([www.quant-aq.com](http://www.quant-aq.com)) capable of measuring PM<sub>1</sub>, PM<sub>2.5</sub>, PM<sub>10</sub>, NO<sub>2</sub>, O<sub>3</sub>, and CO at schools across Pima County, Arizona. The MODULAIR units, after collocation and installation at schools, will run continuously during (and after) the course of the study. The 1-min data from these instruments will be uploaded in real-time to the cloud. We will construct spatiotemporal prediction models and an online data platform to share measurement/modeled data with the public.

Data Quality Objectives and Indicators: Prior to deployment at schools, we will co-locate 30 MODULAIR units at the PDEQ Children's Park NCore site (AQS ID# 040191028) which has PM and multiple gas (NO<sub>2</sub>, O<sub>3</sub>, and CO) regulatory monitors running. We will conduct collocation for two months and examine 1) between-unit variability; 2) agreements between the regulatory monitor and MODULAIR measurements; and 3) the potential impact of relative humidity and temperature on measurements. To adjust for deviations between the units and/or differences against the regulatory monitor, we will fit statistical models to adjust for such differences. Specifically, the MODULAIR readings will be the independent variable and regulatory monitor readings will be the dependent variable. The calibration models will additionally explore the potential impact of non-linearity and adding humidity and temperature as variables. Raw vs. calibrated MODULAIR measurements will be compared against reference readings via  $R^2$  values and root mean squared errors (RMSE). We will aim to have MODULAIR instruments within 10% (for particles) and 20% (for gases) of regulatory monitor readings, and 10% differences between each instrument after the calibration. Given the potential for sensor decay or drift, we will again co-locate the sensors at the midpoint in year 2 and at the end of the study period (for two weeks each) for verification and to examine whether calibration curves are still similar and thus adequate. The calibration equations for each monitor as well as calculations on bias, precision, accuracy, and data completeness during the initial collocation session will be prepared as a short report to be shared on the online data portal.

MODULAIR monitors use internal Alphasense sensors. In their prior collocation sessions against reference instruments in Pasadena, CA and St. Louis, MO, QuantAQ reports 1-hour average  $R^2$  of 0.899 for PM<sub>1</sub>, 0.936 for PM<sub>2.5</sub>, and 0.810 for PM<sub>10</sub>. Vendor reported accuracies for O<sub>3</sub>, CO, and NO<sub>2</sub> are 5 ppb, 40 ppb, and 6 ppm, respectively. We will compare our collocation numbers with reported numbers. The collected data from co-locations will be shared and discussed between Pima Department of Environmental Quality and UArizona researchers prior to report preparation.

Previous works have found that QA/QC processes can add significant costs to low-cost sensor projects that dwarf instrument costs. The repeated removal and re-installation of sensors needed for more frequent collocation at regulatory sites are therefore likely to be difficult, especially since they are to be installed at many schools spread over Pima County. During the course of the study, we will therefore employ a 'mobile calibration' approach to minimize costs associated with QA/QC and disruption to schools. We will use the University of Arizona's (UArizona) multiple Aeroqual S500 units with available PM, NO<sub>2</sub>, CO, O<sub>3</sub> sensor heads. In this approach, we will co-locate the multiple Aeroqual monitors to regulatory monitors during the initial collocation session, and for a set time (1 week) prior to each mobile calibration session. Then we will co-locate and operate the Aeroqual units to compare readings against MODULAIR at each school location (2 days). Although not as comprehensive as collocation at regulatory monitors, this will still allow us to detect significant problems and sensor drift. If sensor drift is detected, then we will re-do 2 weeks of collocation at regulatory sites to construct an adjusted calibration curve. Mobile calibration will be led by PDEQ, while data check will be led by UArizona.

Project Schedule: We will conduct mobile calibration every 3 months in non-summer seasons, and every 1 month during the hot months (Jun-Aug), especially as high heat could accelerate sensor deterioration. PDEQ will lead collocation and mobile calibration, while UArizona will help interpret the data and construct the calibration curves. We will also review the collected data during the monthly data preparation (details below) to



detect sensor decay or failure (e.g., wildly fluctuation measurements or constant zeros). If sensor or equipment failure is identified, then the sensor will be flagged on the online portal. We will attempt on-site repairs within 5 business days, and we will contact the vendor immediately if replacement of internal sensors is needed. Previously collected data by the flagged instrument will also be reviewed. During our monthly meetings, we will discuss data and sensor failures, and on updating the QA/QC methods as necessary.

Data Collection, Management, and Review: Instrument installation by PDEQ will be done on a case-by-case basis after consulting with school officials at each location and determining the exact location on school grounds and power source, and with priority for fenced-in areas. Collected raw data will be automatically uploaded to the secure QuantAQ cloud and stored. Then from the QuantAQ Cloud, the data will be pulled via the API (application programming interface) and streamed near real-time to our online data portal that will be constructed as part of this project. The real-time data will show adjusted readings using calibration curves developed from the initial collocation. Downloadable data (in csv format) of the previous month will be prepared and shared during the second week of every month after ongoing quality control. During quality control, we will flag potential outliers and remove erroneous measurements (e.g., negative values). Data download will include several different temporal aggregations that can be changed via the user interface (e.g., 1-min average, 10-minute average, 1-hr average, and 24-hour average) along with time, relative humidity, and temperature data. Both raw and calibrated data will be available for download. At least 45 min of valid data will be required to calculate an hourly average (i.e., 75% data completeness). Monthly prepared data will be also saved on a separate UArizona server for backup. Data management and review will be led by UArizona (Dr. Chris Lim).

## PIMA COUNTY – EPA Air Monitoring Environmental Justice AREAS AFFECTED

Services are available throughout Pima County. Potential areas of impact include Tucson and surrounding suburban and rural cities and townships, unincorporated areas, and tribal communities located in and around the Pascua Yaqui, San Xavier, and Tohono O'odham reservations.

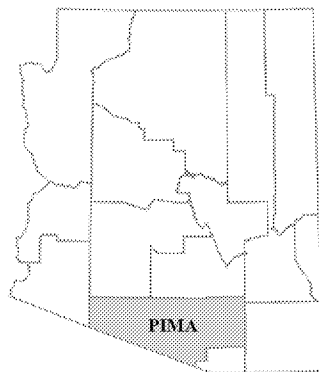
Pima County communities and populated areas include:

Tucson  
Oro Valley  
Sahuarita  
Flowing Wells  
Picture Rocks  
Avra Valley  
Three Points  
Ajo  
Littleton  
Santa Rosa  
Topawa  
Gu Qidac  
Maish Vaya  
Ali Chukson  
Rillito  
Ali Molina  
Ko Vaya  
Ak Chin

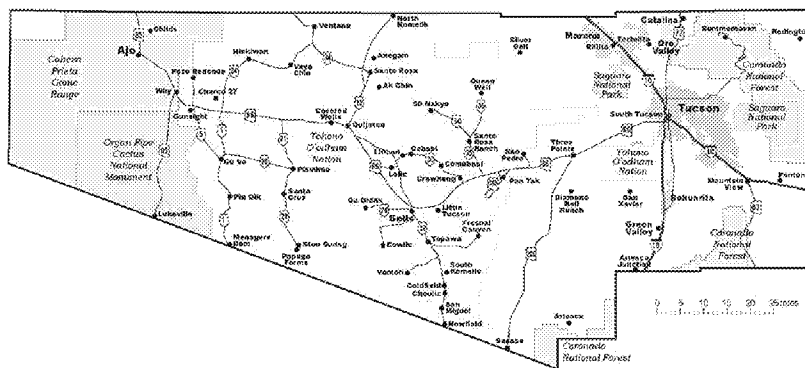
Casa Adobes  
Marana  
Green Valley  
Tucson Estates  
Valencia West  
Corona de Tucson  
Summit  
Sells  
Arivaca  
Elephant Head  
Nelson  
Why  
Anegam  
Wahak Hotrontk  
Haivana Nakya  
Charco  
Summerhaven  
Comobabi

Catalina Foothills  
Drexel Heights  
Tanque Verde  
Vail  
Catalina  
South Tucson  
Rincon Valley  
Arivaca Junction  
Pimaco Two  
Pisinemo  
San Miguel  
Ali Chuk  
Cowlic  
South Kimolik  
Chiawuli Tak  
Ventana  
Nolic  
Willow Canyon

### ARIZONA

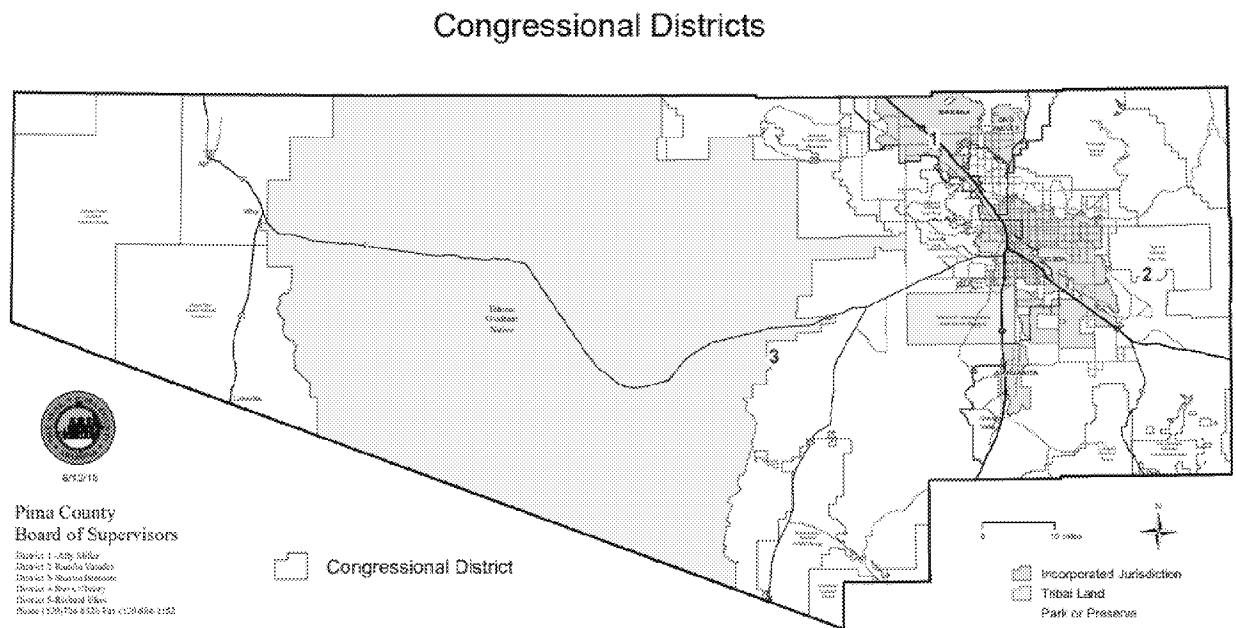


### PIMA COUNTY



**PIMA COUNTY Enhanced Air Quality Monitoring for Communities  
Expanding Localized Air Quality Monitoring at Pima County Schools  
To Address Environmental Justice  
CONGRESSIONAL DISTRICTS**

Pima County encompasses portions of three Arizona Congressional Districts: AZ-001, AZ-002, and AZ-003. The map below identifies the areas of each Congressional District located in the County-wide service area.



## EXPANDING LOCALIZED AIR QUALITY MONITORING AT PIMA COUNTY SCHOOLS TO ADDRESS ENVIRONMENTAL JUSTICE

**Applicant:** Pima County

Department of Environmental Quality (PDEQ)

33 N. Stone, 7<sup>th</sup> Floor

Tucson, AZ 85701

Natalie Shepp: 520-724-6885; Natalie.shepp@pima.gov

DUNS: 074477969

**No Set Aside**

**Mission:** Pima County Department of Environmental Quality's (PDEQ) mission is to preserve and protect the environment of Pima County for the long-term benefit of residents' health, welfare, safety, and quality of life. As part of our mission, PDEQ identifies and responds to environmental issues by providing public services such as monitoring, analysis, information, education and solid waste management.

**Project partners:** University of Arizona Mel and Enid Zuckerman College of Public Health (MEZCOPH)

University of Arizona Asthma & Airway Disease Research Center (A2DRC)

University of Arizona Southwest Environmental Health Sciences Center (SWEHSC)

Chris Lim, Ashley Lowe: primary Partner contacts

**Project location:** Schools located within Pima County and as described in Section 3. Seven public school districts within the Tucson metropolitan community have expressed interest but individual schools not yet identified for inclusion. However, most of participating schools will be located on the near Interstate 10 and the southern side of Tucson.

**Air pollutant scope:** PM<sub>1</sub>, PM<sub>2.5</sub>, PM<sub>10</sub>, CO, O<sub>3</sub>, NO<sub>2</sub>

**Budget Summary:**

EPA Funding Requested	Total Project Cost
\$488,210.33	\$488,210.33

**Project Period:** July 1, 2022-June 30, 2025

**Short Project Description:** The applicant and partners will leverage relationships with multiple school districts throughout Pima County to deploy and operate additional low-cost outdoor air pollution sensors improving exposure measurements of selected air pollutants for the entire population, especially identified environmental justice locations. Based on data collected by these sensors, project partners will develop models to predict air pollution levels across the county and develop action plans. Finally, the partners will use the data to develop modules to educate students for community science efforts, such as education sessions on air pollution and related health effects and the relationship between data and localized environmental justice issues identified by the students.

## WORKPLAN

### Section 1: Project Summary and Approach

Recent studies have found that minority and low-income populations are disproportionately exposed to higher air pollution levels.<sup>1</sup> These higher air pollution levels may contribute to disparate health outcomes in these communities. Air pollution levels can vary significantly over space and time,<sup>2</sup> and exposures to these peaks of air pollutants can trigger adverse health effects, such as asthma and cardiovascular symptoms. The current paradigm of regulatory monitor networks reporting hourly values is insufficient in characterizing the air pollution levels where public live, work and play. Pima County is no exception, with an insufficient number of sensors deployed to monitor air quality, particularly in traditionally underserved communities within the jurisdiction. Recent advancements and the adoption of low-cost sensor technology have created new opportunities to measure air quality with much higher spatiotemporal coverage than government regulatory monitors, which will allow for identification of pollution “hotspots” and provide the evidence needed to enact targeted policies aimed at reducing emissions. Through this grant, PDEQ will leverage the technological capabilities of these sensor technologies to measure air quality in Pima County schools within an environmental justice framework.

Monitoring Network for Air pollutants in Tucson: There are 2 CO monitors, 2 NO<sub>2</sub>/NO<sub>x</sub> monitors, 1 SO<sub>2</sub> monitor, 8 O<sub>3</sub> monitors, and 7 PM<sub>2.5</sub>/PM<sub>10</sub> monitors across 14 sampling locations within Pima County. Although the current monitoring network is sufficient to meet regulatory requirements and assess potential exceedances, it is limited in characterizing localized air pollution patterns across space and time. Although exceedances are generally not observed, high air pollutants levels are a concern in certain locations. There may be still potentially harmful levels of air pollutants, especially given the recent evidence that air pollution health effects are observed at levels lower than the federal standards. The current network of stationary sensors cannot characterize the spatial variability and temporal variability in detail. Furthermore, Tucson and Pima County also have experienced significant population growth and expansion to the outskirts of the town, with a lot of the new expansions near the I-10 highway and where there are no existing monitors.

This grant will focus on air pollutants that are known to be problematic in Pima County (PM<sub>1</sub>, PM<sub>2.5</sub>, PM<sub>10</sub>, CO, O<sub>3</sub>, and NO<sub>2</sub>). To expand capacity, PDEQ and partners will install 30 MODULAIR (QuantaAQ) monitors across Pima County to supplement an ongoing project of 30 PurpleAir installations, and to create a distributed sensor network. This project has 3 interconnected aims to address air quality issues in Pima County and promote environmental justice. The overall project aims include:

**Aim 1: Establish a network of low-cost sensors measuring particulate matter and gaseous pollutants in Tucson area schools:** PDEQ and partners will establish a distributed network of low-cost monitors (QuantaAQ Modulair) measuring multiple air pollutants described above in 30 Pima County schools. Sensor locations will be selected to target environmental justice locations and schools nearby major pollution sources. This sensor network will be supplemented by a similar but separate project between PDEQ and MEZCOPH, A2DRC and SWEHSC installing PurpleAir PM monitors at 30 schools. The partners will leverage ongoing relationships between PDEQ, MEZCOPH, A2DRC, SWEHSC, and 7 Pima County public school districts to install, launch, and maintain this sensor network. Sensor locations will be selected in partnership with each of the participating school districts to include multiple sensors in each district with at least 1 sensor placed at a high school in each of the school districts. Sensor locations will also be selected based on the school’s location and proximity to suspected problematic air pollutants.

Sensor Description: MODULAIR provides real-time estimates of particulate matter (PM<sub>1</sub>, PM<sub>2.5</sub>, PM<sub>10</sub>), particle size distribution, and up to five user-selected gas-phase pollutants (choose from CO, CO<sub>2</sub>, NO, NO<sub>2</sub>, O<sub>3</sub>, SO<sub>2</sub>, H<sub>2</sub>S). The instrument also measures relative humidity and temperature. Each unit is internet-connected and paired with the QuantaAQ Cloud. MODULAIR is easily deployed as a standalone unit or as part of a distributed air quality sensor network. Available add-on accessories include meteorological measurements (wind speed and

wind direction via a sonic anemometer) and a standalone solar and battery solution to allow off-grid use. Sensor specifications can be seen here (<https://docs.quant-aq.com/modulair>).

**Aim 2: Construct spatiotemporal models applying land use regression and machine learning approaches to predict air pollution levels across Pima County:** Through this effort, spatiotemporal models applying land-use regression (LUR) and machine learning approaches to predict air pollution levels across Pima County will be developed. Additionally, an interactive and publicly available online viewer to visualize air quality trends and map patterns with high spatiotemporal resolution will be developed. This platform will also include historical data (both raw and processed) available for download.

Spatiotemporal Modeling: Land-use variables using geographical information systems (GIS) variables around each school location will first be collected. GIS variables will come from OpenStreetMap, an open-source GIS data platform, or the Pima County open data portal. The data collected from MODULAIR will be processed and temporally aggregated into 10-minute averages and potentially erroneous data (e.g., from GPS errors or extreme outliers) will also be corrected. The collected data will be then used to construct predictive air pollution models using land-use regression approaches.<sup>3</sup> LUR uses geographic variables as predictors of air pollution levels at a given location. We will extract land-use variables within circular buffers of varying distances (e.g., 100m, 500m, 1km) around a school with a monitor. Real-time meteorology (temperature, humidity, and wind speed) from the instrument and traffic information will also be incorporated to add a temporal component to the prediction model. Several machine learning algorithms (e.g., random forest, XGBoost, decision trees) will be applied to construct separate predictive models for the gases, PM<sub>1</sub>, PM<sub>2.5</sub>, and PM<sub>10</sub> concentration levels at a very fine spatiotemporal scale in Tucson.

To allow the machine learning model to utilize the spatial and temporal correlations in the data, a unique identifier variable for each grid point, year, day, and 10-minute time period will be included in the training data. Similar to past spatiotemporal models for environmental exposures utilizing machine learning, a convolution layer value for each period is assigned as the median of daily measured exposure variable medians on the previous, current, and next time periods. Variables selected are then aligned to a prediction grid, then used to train random forest regression models consisting of *n* trees and a minimum node size of 5. We will conduct 10-fold cross-validations (CV) to test the model's predictive performance, where the entire training dataset will be randomly split into ten subsets containing approximately 10% of the training data. In each round of cross-validation, nine subsets are used for model training and to predict the held-out test subset. The process can be repeated until every subset is tested. The moving average of air pollution/temperature measurements over the previous 1 to 24 hours in 10-minute intervals of each grid and its neighboring grids within 1-km will be included in the model to account for temporal autocorrelation. The gridded prediction values will be aggregated to the corresponding census block. Using this approach, a 10-minute level estimates of air pollutants across Pima County will be generated for each census block, significantly improving the spatiotemporal coverage of the current methods.

Interactive Data Viewer: An interactive and publicly available online viewer will be developed and launched to visualize hyperlocal air quality trends and spatial patterns. Using an online data analysis and visualization app for R, an interactive and publicly available online viewer will be constructed. A data feed using the API from the QuantAQ sensors will be created. The data is stored on the cloud by the vendor (QuantAQ Cloud), allowing for access from the storage directly. The API feed will be used to create an interactive map of locations. Using the results from Aims 1a & 1b, an additional map will be created to visualize measured and modeled results depicting spatial patterns of predicted air pollution levels, which will be shared publicly so that students, parents, educators, public officials, and residents can see and understand their exposure levels. The site will be developed by MEZCOPH and the link will be shared on the PDEQ website and shared with school districts via newsletters and social media.

**Aim 3. Develop community science education plans at schools to educate students:** We will develop a multi-faceted partnership between PDEQ, MEZCOPH, A2DRC, SWEHSC, and 7 local public-school districts consisting of 178 schools to develop three educational modules aimed at student-led community science efforts; understanding the data and data stewardship; working with mobile low-cost sensors (AirBeam); air pollution science and its related health effects, and the relationship between the data and localized environmental justice issues identified by the students. Table 1 shows characteristics of the participating schools.

**Table 1. Public Schools in Pima County, Arizona participating in the *Expanding Localized Air Quality Monitoring to Address Environmental Justice*, 2022.**

School District	Number of Schools	Number of High Schools	Student Enrollment Total	Families with income below the federal poverty level	Families with Food Stamps or SNAP benefits
Flowing Wells Unified School District	10	2	5,409	29.6 %	38.8%
Marana Unified School District (MUSD)	20	3	12,395	9.7 %	13.1 %
Sahuarita Unified School District	9	2	5,734	8.5 %	11.6 %
Sunnyside Unified School District (SUSD)	22	3	14,942	33.3 %	43.6 %
Tanque Verde Unified School District (TVUSD)	4	1	2,127	0 %	0 %
Tucson Unified School District (TUSD)	90	15	41,898	25.2%	31.8%
Vail Unified School District (VUSD)	23	8	13,642	4.1 %	4.2 %
<b>Total</b>	<b>178</b>	<b>34</b>	<b>96,147</b>	<b>--</b>	<b>--</b>

The lessons will facilitate learning approaches for student inquiry, including the analysis of local air pollution data at each of the (30) sensor sites. Students will learn how to make comparisons and inferences on the data variability and the sources that may be contributing to it. All curricula and lesson plans will be geared towards grades 9-12 learners (i.e., high school students). The curriculum will incorporate the Centers for Disease Control and Prevention's (CDC) National Health Education Standards (NHES) into each module and lesson plan.<sup>4</sup> Program curriculum will be designed with the 8 NHES written expectations for students who reach the 12<sup>th</sup> grade.<sup>4</sup> To ensure an effective curriculum is developed, the 14 characteristics of effective curriculum, as outlined by the CDC<sup>5</sup> will be included with the Common Core state standards for grades 9-12.<sup>6</sup> An outline of the proposed curriculum is illustrated in Table 2.

**Table 2. Proposed educational curriculum outline for 9-12 grade students, 2023-2025.**

Curriculum Title	Module	Lesson	Goal	Description
<i>Understanding air quality in Pima County, Arizona</i>	1	1	To increase student knowledge about air quality in Pima County, Arizona.	In this lesson, students take on the roles of learner and teacher as they work in teams to first learn and then teach their classmates about outdoor and indoor air quality. Students will first learn about air quality in Pima County, Arizona and why it is important to use. Definitions of air pollution and the local problems will be discussed including an introduction to the tools we use for measuring air quality. Students will use a hands-on approach for learning how the tools (QuantaAQ and AirBeams) work, and what type of data can be obtained from these monitoring tools in the school setting. Students will explore ways to address air pollution challenges in the context of their local community.

Curriculum Title	Module	Lesson	Goal	Description
<i>Using scientific methods to measure air quality in Pima County, Arizona</i>	1	2	To explore how to use QuantAQ and AirBeam technologies for measuring air quality in the school setting.	In this lesson, a hands-on approach to exploring the QuantAQ and AirBeam technologies will be used to introduce students to measuring air quality data. Students will learn how scientists use the scientific method for sensor calibration, obtaining data, cleaning and munging, and analyzing these data.
<i>A student-led approach to examining air quality at their school</i>	2	3	To develop a student-led, data-driven project that measures air quality at their school.	In the lesson, students will design a project that measures air quality inside their school and compares it to the air quality outside the school.
<i>Data, data and data!</i>	2	4	To examine air quality data obtained from the air quality sensors.	In this lesson, students will examine the data obtained from their student-led project and learn how to format their data in preparation for scientific analysis. Students will explore differences in air quality and make comparisons to data obtained from other school sensor sites.
<i>Environmental Justice in Pima County, Arizona</i>	3	5	To provide a history of environmental justice in Pima County Arizona and major issues with air quality and events.	In this lesson, students will learn about the history of the environmental justice movement and its implications in Pima County, Arizona. Students will learn about these major issues and how it has affected the community members in Pima County.
<i>Leveraging community capacity to ensure better air quality for all peoples in Pima County, Arizona</i>	3	6	To explore existing community resources and key stakeholders to improve air quality in Pima County, Arizona.	In this lesson, students will explore existing community resources and the key stakeholders involved with air quality improvements in Pima County, Arizona. Students will present the findings of their student-led projects.

Partners will work closely to assist high school teachers with implementing the educational curriculum in their classroom setting. PDEQ anticipates A2DRC and SWEHSC employees, and other area undergraduate and graduate public health students (i.e., interns) will lead the education efforts in participating high schools. By partnering with these institutions, the program leverages a multi-tiered educational approach for collecting and analyzing air quality data while teaching students about the connection between air quality to localized environmental justice issues. High school students who are interested in expanding their involvement on these topics will also be given the opportunity to join PDEQ's Youth for Blue Skies after school program, providing a platform for constructive environmental justice advocacy for their local communities.

## **Section 2: Community Involvement:**

Community Partnerships: PDEQ, MEZCOPH, A2DRC and SWEHSC intend to leverage their strong expertise in the fields of air quality monitoring and data collection, public outreach, environmental justice, and environmental science curriculum development to create and implement an innovative program that will considerably expand publicly available localized air quality data in underserved communities and provide meaningful educational opportunities for young people to learn from the data collection and associated environmental justice issues.

PDEQ Outreach and Education Senior Program Manager, Natalie Shepp, MPH, will lead the management of the grant and ensure that the deliverables are completed as outlined. Ms. Shepp is the program lead for the PDEQ Clean Air Program and Lawn and Garden Voucher program grants from the Arizona Department of Environmental Quality. She has extensive experience in grant management, stationary and mobile source air pollution emissions



inventories, air quality compliance, mobile source modeling, and developing and implementing outreach and education programs that promote reducing air pollution emissions. She will also utilize her extensive experience in experiential education, curriculum development, and quantitative and qualitative program evaluation, to collaborate with MEZCOPH, A2DRC and SWEHSC to develop and implement the educational modules for the high school students. Ms. Shepp is also the PDEQ Environmental Justice Manager and will work with the partnering institutions, local school districts, and local community members to identify environmental justice issues that are of concern in underserved communities to analyze the possible factors associated with air quality data variability in different regions of Pima County. Ms. Shepp also has experience with the EJ Screen tool and will be involved in utilizing it to determine the most appropriate sites for the sensors, as well as working with the students to utilize it for their analyses. She is also a Senior Program Manager for Outreach and Education for PDEQ.

PDEQ Air Quality Monitoring Manager, Mike Draper, has two decades of air quality monitoring, quality assurance and data management experience. Mr. Draper and Instrument Specialist Trinidad Alvarez, will be responsible for co-locating the new sensors with the existing permanent air quality monitoring sites in order to collaborate the instruments to ensure data reliability.

At our partnering institution, MEZCOPH, Chris C. Lim, PhD, MS, will lead the development of spatiotemporal modeling of air pollutants. He is an environmental epidemiologist with extensive experience working with low-cost sensors for personal-level exposure assessment and air quality modeling. Specifically, he has employed low-cost sensors and community science-based approaches for particulate matter modeling in Seoul, South Korea, and in New York City working with environmental justice community organizations. He has collaborated closely with HabiMap, the maker of AirBeam, in sensor development and calibration to date. He also has experience developing interactive R Shiny apps using low-cost sensor data (<https://cchaeha.shinyapps.io/Shiny/>)

Ashley Lowe, PhD, MSPH, A2DRC, has extensive experience working with local schools to deliver evidence-based health education interventions. Dr. Lowe's experience includes working with 250 charter, private/parochial and public schools to implement a stock medication program in Pima County schools. The Stock Inhaler for Schools program is currently in its sixth year with all schools continuing their participating over this course of 6 years. She is currently collaborating with local Public Health Department officials to expand the aims of this program in partnership with schools to develop a robust training program for teachers and health personnel. Her experience also includes implementing the American Lung Association's evidenced-based asthma education, "Open Airways for Schools®" in elementary grade levels. Through her existing partnerships, her team will work closely with 7 local school districts and their administrators and teachers to develop a student-driven, educational curriculum. She will hold multiple meetings with our community and school partners to develop 3 educational modules with 6 lesson plans related to air pollution and environmental justice. Dr. Lowe will also work with school district administrators to gain approval from each participating school to participate in the program.

Benjamin Richmond, MPH, SWEHSC, has vast experience working with community-based organizations on environmental health issues. As part of its mission of being an unbiased resource for communities, SWEHSC has vast experience engaging communities and youth about environmental health (EH) and environmental justice (EJ) issues. SWEHSC addresses structural EH inequities through its pipeline of five sequential science-based programs aimed at increasing middle school through undergraduate students' knowledge and interest in EH. During these programs, students participate in hands-on EH curriculum designed by SWEHSC that teaches students about general EH concepts and increases students' knowledge of local historical and current EJ topics. SWEHSC has worked with students, teachers, and schools across Arizona to engage youth in EJ and incorporate EH both in and out of the classroom setting. Benjamin's team will work closely with the team to implement the educational curriculum in 7 high schools from each of the 7 participating public school districts.

To ensure sustainability of the educational program, the sensors located at the schools will remain in place and the data will remain publicly available even after the grant period ends. A downloadable toolkit will be created for

schools, teachers and interested stakeholders. The educational curriculum (3 modules and 6 lesson plans) will be adapted to a downloadable toolkit accessible on PDEQ's website. This approach ensures all schools (whether participating or non-participating) have access to the educational curriculum which might be implemented later. A training video will also be created that is aimed at training high school teachers who are interested in incorporating the educational curriculum in their classroom. The training video will be hosted on PDEQ's website and included with the downloadable toolkit (i.e., educational curriculum). Training video content will include the following items: 1) Step-by-step instructions on how to access the air quality data from the air quality sensors; 2) Detailed instructions regarding how to download and format the sensor data for student use; 3) Suggestions for how to incorporate the educational curriculum (3 modules and 6 lessons) into their current classroom curriculum; and 4) Strategies for student engagement with community members and environmental justice leaders in Pima County, Arizona.

Community Engagement: Community engagement is an essential component of this project and will build on the existing relationships already developed by Dr. Lowe through the stock education program described above. One-hundred seventy-eight public schools, Pima County Superintendent of Schools and the Pima County Health Department have submitted Letters of Support for this proposal, demonstrating the need for this type of data collection, dissemination, and community involvement.

PDEQ and partners intend to collaborate with these local school districts reaching underserved communities to select school sensor sites that represent a cross-section of communities with a wide variety of nearby air pollution sources. The interactive data viewer will serve to enhance community engagement and dissemination of the results. The collected data and modeling results will be publicly shared as open data, such that community members and interested parties can use the data to drive local and state-level policy. Identification of hotspots and pollution sources can drive outcomes, including increased community awareness, increased access to information, and mitigation actions from multiple stakeholders. While each school district will work in partnership with this team to develop the 3 modules and 6 lesson plans, all educational content will be adaptable to the unique settings of each school district.

Pima County schools span across a large geographic area, each district with a diverse set of resources. Given vast differences in resources and settings, relying on a standardized curriculum may not be appropriate for each and every district that participates in this program. Therefore, this partnership will work closely with district administration to create an educational curriculum that appeals to the unique characteristics of each school district. PDEQ anticipates aspects of the educational curriculum may need to be modified for each district setting and approved by each district administration before implementation in the classroom setting.

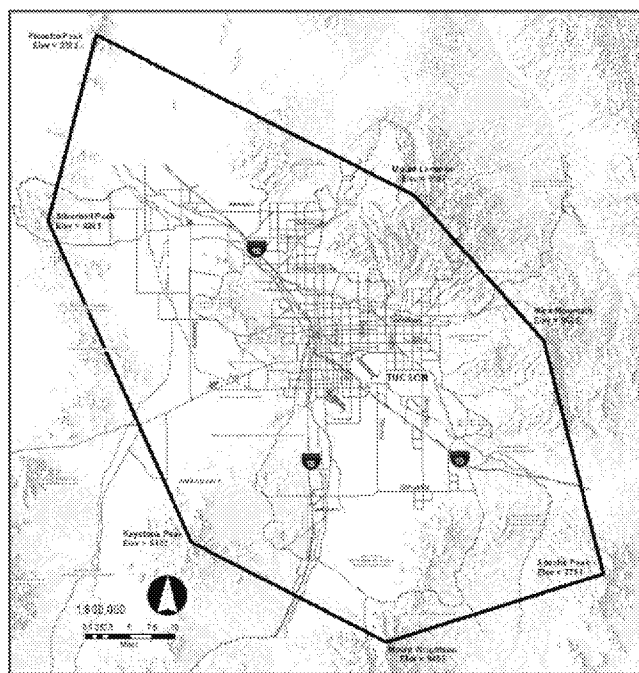
### **Section 3: Environmental Justice and Underserved Communities:**

Environmental Justice is of considerable importance to the residents of Eastern Pima County, particularly on the South Side of Tucson, with previous Trichloroethylene (TCE) contamination in local groundwater wells and a disproportionately high number of air pollution sources co-located in areas with the highest minority and lowest income populations. Locations of concern include schools near the Tucson International Airport, (which is also a Superfund site), Davis-Monthan Air Force Base; along the I-10 highway, the Tucson Electric Power generating station, the Los Reales landfill, and a nearby PFAS water plume (see also a description of the Tucson Air Planning Area in Attachment 1). Most recently, a medical sterilization facility that utilizes Ethylene Oxide (a hazardous air pollutant and known carcinogen) in its operations are also planning to open a new facility in this area. This is contributing to the area's EJ concerns and how they are currently being exacerbated instead of abated.

This funding will allow data collection that is needed to assess, through a collaborative community-science effort, the possible local variability in air pollution in different regions of Pima County, ultimately giving the residents the data they need to demonstrate those inequities and work toward identifying how local policy decisions can control progress to improve living conditions for local communities on the Southside.

COVID-related inequities have also been highlighted over the last two years of the pandemic. According to a report developed for Pima County's District 5, which includes the Southside of Tucson, "...there is a clear picture that the county's most vulnerable pre-COVID census tracts are disproportionately impacted during COVID." 22 census tract COVID hotspots were identified in District 5 neighborhoods with the majority of the population on the Southside, with residents identified by more Hispanic, poverty-stricken, on food stamps, and uninsured than the average of the rest of the city and county. As such, many of these census tracts score high on social vulnerability indices. Therefore, it is evident that the virus and the sources of air quality pollution are disproportionately located on the Southside of Tucson.<sup>7</sup> Since COVID is predominantly a respiratory illness, it is essential that localized air pollution sources be monitored more closely in order to dismantle these inequities and improve these communities living conditions and overall health over time.

**Figure 1: Eastern Pima County Tucson Air Planning Area**



The climate of Tucson is characterized by a hot season normally starting in April and ending in October, and a generally mild winter. Maximum daily temperatures from May through September are usually above 90 degrees Fahrenheit. The average rainfall is around eleven inches per year. Tucson International Airport records show an average of 240 clear days a year (days with less than 50% total cloud cover). The remaining periods include the winter prefrontal situations more common in the north and the prolonged seasons of convective summer storms. Wind velocity and direction changes, associated with large-scale pressure systems, frequently result in localized dust storms and high particulate matter levels. Given the environmental and social vulnerability of communities within the planning area, many residents lack the resources to mitigate the impacts of the area's climate, making data collection, analysis and educational curricula development an important, extra tool for these communities.

This project will address the lack of monitoring data in many Pima County neighborhoods, especially in low-income and environmental justice communities, by greatly expanding the air quality data monitoring network into underserved communities and allowing for the public dissemination of the data. PDEQ will also utilize the EPA EJScreen tool to identify and display communities with low incomes, minority populations, those nearby currently permitted air pollution sources and other environmental hazards, higher populations of vulnerable people (children, elderly), and linguistic isolation. Study locations will be selected in a reiterative process. First, our team will create a list of candidate schools using the EJScreen tool and knowledge of local pollution sources. We will then consult with school districts with a list of candidate schools to select final sensor locations, with a priority for high pollution locations of concern. 20 locations nearby pollution sources and major roadways will be selected, as well as 10 locations in relatively cleaner areas without existing regulatory monitors. This will provide the spatial contrast/variation needed to create models and prediction maps as described in Aim 2.

The sensor network, spatiotemporal models, and online data portal developed from this project will allow for the characterization of multiple air pollutants at a very fine spatiotemporal scale in Tucson. This air pollution prediction model can be used to link the estimated exposure to ongoing population datasets and student-based cohorts at The University of Arizona as well as develop connections with local organizations to launch

environmental justice initiatives to identify local pollution hotspots. Assessing air pollution levels for students at schools, which is especially vital given that children are especially vulnerable to the effects of air pollutants.

#### Section 4: Environmental Results: Outcomes, Outputs and Performance Measures:

Outputs will include the generation of a summary report (available on PDEQ website) on collocation and comparison of Modulair sensor performance against Pima county regulatory monitors. The report will contain methods, tables, figures, and statistical analyses including R2 calculations between the two instruments. Another output is the deployment of sensors at Pima county schools. Short-term outcomes will include increased problem identification (from consultation with school districts, parents, and communities), and community awareness from the knowledge that sensors were deployed at certain locations.

For Aim 3, performance will be measured by the short-term impacts provided in the logic model (Table 2). Short-term impacts include measuring student participation in the program (i.e., attendance), student knowledge, student leadership skills, teacher knowledge and the participation of MEZCOPH undergraduate and graduate student interns. A pre- and post-evaluation survey will be administered to participating school district administrators, teachers and high school students who participate in the program. Lastly, a post-program impact evaluation will be conducted in partnership with SWEHSC.

**Table 3. Project Timeline:**

Activity	Year 1				Year 2				Year 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Recruit schools & obtain approval												
Hire/train project staff												
Purchase air sensors												
Co-location with regulatory monitors												
Install air sensors in 30 schools												
Monitor air quality and obtain data												
Consult with Pima County Health Department (PCHD)												
Consult with community partners including schools and SWEHSC												
Implement a school-based, student-led science program in participating high schools												
Create an educational toolkit & training video												
Create an online download, analysis, and visualization portal												
Data modeling, cleaning & analysis												
Manuscript & report generation												

**Section 5: Quality Assurance Statement:** See attached QA/QC Statement.

#### Section 6: Programmatic Capability and Past Performance:

PDEQ and its predecessors have conducted air monitoring in the Tucson, Arizona area since the 1960's. PDEQ monitors ambient (outdoor) air pollutants at 15 monitoring stations located throughout eastern Pima County, including the Tucson metropolitan area and Green Valley. More information regarding PDEQ's air monitoring program is available in the [2020 Ambient Air Monitoring Network Plan](#). A map of monitoring locations and information about each site is located on [PDEQ's Air Monitoring website](#). In addition to the sites located on this map, PDEQ operates four other monitoring stations that are not able to be polled electronically.

The air quality monitoring section is divided into 3 units; the Field Monitoring unit, the Data Management unit and the Quality Assurance (QA) unit. The field monitoring unit conducts all quality control procedures related to routine operations such as calibrations, equipment checks, troubleshooting and repair of equipment necessary for air quality monitoring. The data management unit handles all operations related to network operations, data acquisition, management, storing and reporting of data. The QA unit operates independently of the field monitoring unit to assure the quality and accuracy of the data recovered.

**Table 4: EPA grants received by PDEQ in last three (3) years:**

GRANT	GRANTOR	GRANT PERIOD(S)	APPLICATION AMOUNT	DISPOSITION
CAA 103 PM2.5	U. S. Environmental Protection Agency	4/1/2019-3/31/2020 4/1/2020-3/31/2021 4/1/2021-3/31/2022	\$108,199.00 \$114,199.00 \$108,199.00	Successfully completed Successfully completed Awaiting final award; successfully spent down
CAA 105	U. S. Environmental Protection Agency	10/1/2019-9/30/2020 10/1/2020-9/30/2021 10/1/2021-9/30/2022	\$517,064.00 \$522,061.00 \$564,892.00	Successfully completed Successfully completed In progress; on task
CAA 103 Near Road NO2	U. S. Environmental Protection Agency	2/20/2020-extended to 3/30/2022; second extension request submitted for 6/30/2022	\$200,000.00	Awaiting final electrical connection; all other construction activities complete; requested extension to June 30, 2022 to allow for accounting closeout. Project fell behind due to COVID-related staffing/scheduling/supply chain challenges.
ADEQ18-198217 Voluntary No Drive Day/Clean Air Program	State of Arizona	7/1/2019-6/30/2020 7/1/2020-6/30/2021 7/1/2021-6/30/2022	\$268,250.00 \$283,000.00 \$268,250.00	Successfully completed Successfully completed In progress; on task
EV19-0009 Voluntary Lawn Equipment Emissions Reduction	State of Arizona	7/1/2019-6/30/2022	\$352,200.00	In progress; on task; planning 22-23 extension

#### **Section 7: Budget Justification:**

**Personnel:** A *Senior Program Manager* will spend .10 FTE in Year One on this project; .15 FTE in Year Two; and a .20 FTE in Year 3 as oversight and analytical responsibilities increase. At an hourly rate of \$31.06, budget relating to the Senior Program Manager is:  $\$31.06 * ((2080 * .1) + 2080 * .15) + 2080 * .20$ ), for a total three-year salary of \$29,072.16. *Air Monitoring Program Manager* – The Program Manager will be a .10 FTE throughout the three-year grant period. At an hourly rate of \$33.27, budget relating to the Program Manager is  $(2080 * 3 * .10) * \$33.27$ , for a three-year salary of \$20,760.48. *Instrument and Control Specialist* - The Instrument & Control Specialist will also be a .10 FTE throughout the three-year grant period. At an hourly rate of \$23.85, budget relating to the Instrument & Control Principal is  $(2080 * 3 * .10) * \$23.85$ , for a three-year salary of 14,882.40. The Air Monitoring Manager and Instrument and Control Specialist will assist in the setup of collocating the sensors with an FEM monitor for comparison purposes prior to sensor deployment at designated locations and assist in troubleshooting data collection when needed.

**Fringe Benefits:** Fringe benefits for Pima County staff are calculated at 37% and are based on the current average fringe rates for Pima County. They include Social Security (6.2%), Medicare (1.45%), Arizona Retirement System (mandatory) (11.5%), worker's compensation (.26%), long-term disability (.25%), unemployment insurance (.26%), health savings account (4.12%), employee assistance program (.01%) and life, health, and dental insurance (12.95%). Total fringe benefits are calculated as  $.37 \times 64517.04$ , for total fringe benefits of \$23,944.56.

**Travel:** Funds are requested for the Senior Program Manager to attend one domestic scientific conference during the project to present and disseminate results, likely an annual conference for the Association of Air Pollution Control Agencies or similar. The travel budget was estimated using historical data of air fares, per diem rates, airport shuttle services, and conference registration fees and/or car rental.

**Supplies:** Supplies include purchase of 10 Air Beam sensors @ unit cost of \$250; 30 Quant AZ Modular Sensor @ unit cost of \$4,500 and 30 protective cases @ unit cost of \$100. Total supplies are estimated to equal  $(10 \times 250) + (30 \times 4,500) + (30 \times 100)$ , or \$140,500.

**Contractual:** No contractual relationships are anticipated as part of this award.

**Other:** PDEQ will subaward grant funds to the University of Arizona (UofA) as a subrecipient to help perform program services under this grant. *University Personnel:* UofA will dedicate two faculty specialists to help with sensor placement, data analysis, modeling, curriculum development and implementation and project coordination. Dr. Lim is expected to dedicate 1.8 calendar months' effort during year 1 and 3.0 calendar months' effort in years 2-3. Dr. Lowe is expected to dedicate 2.64 months' effort in years 1-2 and 3.0 months' effort in year 3. UofA will also dedicate a project coordinator to this effort, requiring 3 calendar months' effort for years 2-3. Total University personnel costs are anticipated to be \$126,026 for this project. *University Fringe Benefits:* UofA defines fringe benefits as direct costs, estimating benefits as a standard percent of salary applied uniformly to all types sponsored activities, and charges benefits to sponsors in accordance with the Federally-negotiated rates in effect at the time salaries are incurred. The rates used in the proposal budget are based on the current Federally-negotiated Rate Agreement rate. The rates are as follows: UofA Employees @ 31.00% and Ancillary Employees @ 17.60%. Current DHHS-approved rates for faculty, research staff and students are publicly available online, for total fringe benefits of \$33,396.38. *University Travel:* Includes mileage to schools for project participants, the coordinator and student interns, calculated at an average mileage rate of \$0.585/mile for years 1 and 3. During year 3, mileage funds will be used to reimburse study staff for travel to and from schools while the team works on the student-led data science component of the program. Travel funds are also requested to support project personnel to attend one domestic scientific conference in years 2 and 3 to present and disseminate results, including the annual American Thoracic Society or similar. This travel was estimated using historical data of air fares, per diem rates, airport shuttle services, and conference registration fees and/or car rental. Total travel is estimated to be \$14,633. *Supplies:* UofA is also requesting funding for supplies, specifically 30 mobile hot spots at a unit cost of \$200 (to ensure connectivity, which is a challenge in many parts of the County) or \$6,000; office supplies (to prepare student-led science component, including pens, paper, and other appropriate supplies, estimated at \$2,000); and fingerprint clearance cards, required per Arizona Department of Public Safety guidelines. UofA estimates that it will need five such cards at a unit cost of \$150. Total supply costs are estimated to be \$8,750. *Other Direct Costs:* UofA does not anticipate that it will have equipment, construction, or contractual costs. *Indirect Costs:* indirect cost rate for off-campus other sponsored activity is 26% of Modified Total Direct Costs (MTDC, which are estimated here at \$182,805.38, or \$47,529.40. Equipment, capital expenditures, patient care costs, tuition remission, rental costs, participant support, scholarships and fellowships, and the portion of subcontracts in excess of \$25,000 are excluded from MTDC base used to calculate indirect costs). A copy of UofA's DHHS-approved rate agreement dated June 29, 2021, is available online. The off-campus determination has been made as the work is being conducted at PDEQ. Total other costs are estimated to be \$126,026 personnel + \$33,396.39 fringe + \$14,633 travel + \$8,750 supplies + 47,529.40 = \$230,334.77

**Indirect Costs:** Pima County is requesting indirect costs using the de minimis indirect cost rate of 10% of modified total direct costs (MTDC). MTDC is \$257,159.60 based on personnel, fringe benefits, travel, supplies and the first \$25,000 from the subaward, or \$64,715.04 + \$23,944.56 + \$3,000 + \$140,500 + \$25,000 = \$257,159.60. Total indirect costs are \$257,159.60 \* .10 = \$25,715.96.

**Table 5: Budget**

Line and Itemized Cost	EPA Funding
<b>Personnel</b>	
(1) Program Manager Senior \$31.06*(2080*.1)+(2080*.15)+(2080*.20)	\$ 29,072.16
(2) Program Manager ( .10 *(2080 * 3))*33.27	\$ 20,760.48
(3) Instrument & Control Specialist (.1*(2080*3))*23.85	\$14,882.40
<b>Total Personnel</b>	\$64,715.04
<b>Fringe Benefits</b>	
37% of Salary and Wages (37% * 64715.04)	\$23,944.56
<b>Total Fringe Benefits</b>	\$23,944.56
<b>Travel</b>	
Air Fare and per diem to attend conference on EPA monitoring	\$3,000
<b>Total Travel</b>	\$3,000
<b>Equipment</b>	\$0
<b>Total Equipment</b>	\$0
<b>Supplies</b>	
Air Beam Sensors: 10@ \$250/unit	\$2,500
Quant AZ Modular Sensors: 30 @ \$4500/unit	\$135,000
Protective Cases 30 @ \$100/case	\$3,000
<b>Total Supplies</b>	\$140,500
<b>Contractual</b>	
None	\$0
<b>Total Contractual</b>	\$0
Other: University of Arizona Subaward	\$230,334.77
<b>Total Other</b>	\$230,334.77
Modified Total Direct Cost (MTDC): (Salaries + Fringe Benefits +Travel + Supplies +25,000 Other)	\$270,435.89
Indirect Costs: MTDC * .10 (de minimis indirect cost rate)	\$25,715.96
<b>Total Funding</b>	<b>\$488,210.33</b>
<b>Total Project Cost</b>	<b>\$488,210.33</b>

**References:**

1. Jbaily A, Zhou X, Liu J, et al. Air pollution exposure disparities across US population and income groups. *Nature*. Jan 2022;601(7892):228-233. doi:10.1038/s41586-021-04190-y
2. Patton AP, Perkins J, Zamore W, Levy JI, Brugge D, Durant JL. Spatial and temporal differences in traffic-related air pollution in three urban neighborhoods near an interstate highway. *Atmos Environ* (1994). Dec 1 2014;99:309-321. doi:10.1016/j.atmosenv.2014.09.072
3. Weissert L, Alberti K, Miles E, et al. Low-cost sensor networks and land-use regression: Interpolating nitrogen dioxide concentration at high temporal and spatial resolution in Southern California. *Atmospheric Environment*. 2020;223:117287.
4. Centers for Disease Control and Prevention. National Health Education Standards. Accessed March 20th, 2022. <https://www.cdc.gov/healthyschools/sher/standards/index.htm>
5. Centers for Disease Control and Prevention. Characteristics of an Effective Health Education Curriculum. Accessed March 20th, 2022. <https://www.cdc.gov/healthyschools/sher/characteristics/index.htm>
6. Arizona Department of Education. Academic Standards. Accessed March 20th, 2022. <https://www.azed.gov/standards-practices/>

# *Natalie Shepp*

## **Ex. 6 Personal Privacy (PP)**

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### Education

University of Arizona – Mel & Enid Zuckerman College of Public Health	
Master of Public Health (Health Promotion Emphasis)	2017 - 2019
University of Arizona – College of Agriculture & Life Sciences	
Bachelor of Science; Environmental Sciences (Soil & Water Emphasis)	1994 – 1998

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### Professional Experience

Pima County Department of Environmental Quality	2021 - Present
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#### **Senior Program Manager – Outreach & Education**

- \* Manage outreach programs for the Pima County Clean Air Program (funded by a \$270,000 grant from the Arizona Department of Environmental Quality) with the goal of increasing public awareness of air quality issues and the connection between driving, air quality, and health.
- \* Create and host community events, track and report on grant deliverables and metrics, supervise program staff, and collaborate with community partners.
- \* Oversee environmental justice outreach and reviews, including hosting public meetings, responding to citizens and the media, and ensuring affected communities are informed of potential environmental risks.
- \* Work with PDEQ program staff to ensure that effective outreach messaging exists across all program areas.

University of Arizona Cooperative Extension	2014 – 2021
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#### **Program Coordinator, Senior (4-H Healthy Living & Diabetes Prevention Programs)**

- \* Created and managed all activities of the Arizona 4-H Healthy Living Ambassador program. Teens were recruited and trained to learn about physical, mental, and environmental wellness concepts, and encouraged to become leaders that promote those concepts in their communities.
- \* Managed all aspects of a \$110,000 United Healthcare Food Smart Families grant and a \$86,000 Walmart 4-H Healthy Habits grant, including recruitment, education, qualitative and quantitative evaluation, and reporting of participants in hands-on activities focused on proper nutrition, physical activity, healthy food preparation, and food budgeting.
- \* Developed curriculum, activities, and evaluation criteria for the Tucson Village Farm FARMacy program. Collected qualitative and quantitative data to determine the effectiveness of program participation on intended lifestyle changes.
- \* Collaborated with colleagues on the Hopi reservation to administer the Well Connected Communities grant from the Robert Wood Johnson Foundation, building youth-adult partnerships designed to address policy, systems, and environmental (PSE) changes to improve food insecurity and mental health.



University of Arizona – Pima County Cooperative Extension 2012 - 2014

**Instructional Specialist / Instructional Specialist, Senior. (4-H Healthy Living)**

- \* Managed all aspects of the United Healthcare Eat 4-Health grant and the Walmart Youth Choice, Youth Voice grant, including the creation of the 4-H Healthy Living Ambassador program.
- \* Built strategic partnerships with local schools and community organizations to support a USDA Children, Youth, and Families at Risk (CYFAR) grant to provide in-school healthy living education for several underserved high schools.
- \* Organized the *STEM in the Garden* teacher training, sponsored by the Arizona Department of Education; approximately 80 teachers attended.

University of Arizona – Pima County Cooperative Extension 2011

**Consultant (Tucson Village Farm)**

- \* Organized all aspects of the Learn, Inspire, Move, Eat (LIME) conference, selecting workshop presenters, scheduling workshops and volunteer schedule; successfully conducted all social media marketing and publicity, resulting in a sold-out conference.
- \* Coordinated with Communities Putting Prevention to Work grant (CPPW) staff to invite 50 teachers from participating schools to attend a school garden curriculum training.

Pima Association of Governments 2000 - 2006

**Air Quality Planner**

- \* Conducted regional air quality emissions analyses using transportation emissions models for short and long-range transportation plans.
- \* Compiled air quality-related reports, including air emissions inventories and progress reports.
- \* Quantified air pollution emissions from wood burning in Pima County and drafted a report detailing the analysis.
- \* Published the *2003 Ozone Status Report* for Pima County local jurisdictions that includes information on ozone air pollution monitoring, trends, sources, emissions inventories, transport, emissions reductions strategies, and GIS mapping data.
- \* Assisted with air pollution emission reduction outreach and education efforts.

Pima County Department of Environmental Quality 1998 - 2000

**Environmental Enforcement Officer**

- \* Conducted air quality inspections in order to determine compliance with federal, state and local air quality regulations; prepared written reports for each inspection performed.
- \* Provided outreach and assistance to owners and operators of permitted facilities by explaining environmental regulations, including monitoring and reporting requirements.

**Memberships & Committees**

Pima Association of Governments, Environmental Planning Advisory Committee – Chair

Arizona Forward – 2021 Emerging Sustainability Leaders Program

Association of Commuter Transportation – Member

Community Gardens of Tucson – Board Director

Arizona School Health & Wellness Coalition – Member

**ACADEMIC EXPERIENCE****The University of Arizona, College of Public Health****12/2020 – Current**

- Assistant Professor in the Department of Community, Environment, and Policy

**EDUCATION & TRAINING****Yale University, School of the Environment****02/2019 – 11/2020**

- Postdoctoral Associate (Advisor: Michelle L. Bell)

**New York University School of Medicine****09/2012 – 01/2019**

- Ph.D. in Environmental Medicine
- Thesis: *"Temperature, Air Pollution, and Mortality in the NIH-AARP Cohort"* (Advisor: George Thurston)

**Yale University, Graduate School of Arts and Sciences****09/2010 – 05/2012**

- M.S. in Biostatistics
- Thesis: *"Land Use Regression Modeling of Elemental Carbon in Connecticut"* (Advisor: Theodore Holford)

**Columbia University, School of Engineering and Applied Sciences****09/2006 – 05/2010**

- B.S. in Earth and Environmental Engineering

**PROFESSIONAL EXPERIENCE****NYU Langone Medical Center, New York, NY****09/2012 – 01/2019***Graduate Assistant***Yale Center for Perinatal, Pediatric and Environmental Epidemiology, New Haven, CT****05/2011 – 08/2012***Research Assistant***The Blacksmith Institute/Pure Earth, New York, NY****01/2010 – 05/2010***Intern***Columbia Environmental Microbiology Engineering Lab, New York, NY****01/2007 – 05/2010***Research Assistant***GRANTS & FELLOWSHIPS**Current**Robert Wood Johnson Foundation****2021 – 2024**

Evidence for Action Grant (\$303,972)

*"Impact of Schoolyards to Playgrounds Renovations on Academic Performance and Health of New York City Students"***University of Arizona Health Sciences****2021 – 2023**

Career Development Award (\$219,500)

*"Application of Sensor Systems to Examine the Exposure-Response Relationship between Air Pollution and Asthma Symptoms in Tucson Schools"*Completed**Environmental Protection Agency****2016 – 2019**

STAR (Science to Achieve Results) Graduate Fellowship (\$132,000)

*"Investigation of the exposure-response relationship between fine particulate matter and asthma symptoms using novel mobile sensor systems in NYC children"***National Science Foundation****2015 – 2016**

East Asia and Pacific Summer Institute Grant (US: \$5,070 + Korea: \$3,200)

*"Exploration of Mobile Smartphone Technology to Measure and Model Air Pollution in Seoul"***Air & Waste Management Association, Mid-Atlantic****2014 – 2016**

Air Pollution Education and Research Grant (\$50,000)

*"Exploration of Mobile Smartphone Technology to Measure and Model Air Pollution in New York City" (2014-2015)**"Exploration of Mobile Smartphone Technology to Measure and Model Air Pollution and Health Outcomes" (2015-2016)***American Lung Association****2014 – 2016**

Lung Health Dissertation Fellowship (\$42,000)

"Effects of Air Pollution and Temperature on Mortality in the NIH-AARP Cohort"

National Institute of Health – Environmental Health Sciences

2012 – 2014

National Research Service Award T-32 Training Grant

## HONORS & AWARDS

Andrew Kim Memorial Scholarship, Korean Scientists and Engineers Association, 2018

Abstract Award, American Thoracic Society Annual Meeting, 2017

Student Poster Competition Award, International Society of Exposure Sciences 25<sup>th</sup> Annual Meeting, 2015

Morton Lippmann Scholarship, American Industrial Hygiene Association, 2015

NYU GSAS Dean's Student Travel Grant, 2014 & 2017

## RECENT PUBLICATIONS

\*Corresponding Author

**2021** Son J, Choi HM, Fong KC, Heo S, **Lim CC**, Bell ML. "The roles of residential greenness in the association between air pollution and health: a systematic review." *Environmental Research Letters* (2021)

"Community Air Mapping Project for Environmental Justice" New York City Environmental Justice Alliance February 2021.

**2020** Heo S, **Lim CC**, Bell ML. "Relationships between Local Green Space and Human Mobility Patterns during COVID-19 for Maryland and California, USA." *Sustainability* (2020)

Son JY, Fong KC, Heo S, Kim H, **Lim CC**, Bell ML. "Reductions in mortality resulting from reduced air pollution levels due to COVID-19 mitigation measures." *Science of the Total Environment* (2020)

Hayes RB, **Lim CC**, Zhang Y, Cromar K, Shao Y, Reynolds HR, Silverman DT, Jones RR, Park Y, Jerrett M, Ahn J, Thurston GD. "PM<sub>2.5</sub> Air Pollution and Cause-specific Cardiovascular Disease Mortality." *International Journal of Epidemiology* (2020)

**2019** **Lim CC\***, Kim H, Lee KY, Thurston GD, Gordon T, Vilcassim MJ, Chen LC, Heimbinder M, Kim SY. "Mapping urban air quality using mobile sampling with low-cost sensors and machine learning in Seoul, South Korea." *Environment International* 131, 105022 (2019)

11. **Lim CC**, Thurston GD. "Air Pollution and Diabetes Risk: A Life-course Epidemiological Prospective." *Current Diabetes Reports* 19:58 (2019)

10. **Lim CC\***, Hayes RB, Ahn JY, Shao Y, Silverman DT, Jones RR, Garcia C, Bell ML, Thurston GD. "Long-term Exposure to Ozone and Cause-specific Mortality Risk in the U.S." *American Journal of Respiratory and Critical Care Medicine*, 200(8):1022-1031 (2019)

Accompanied by editorial "Long-term Exposure to Ozone and Cardiopulmonary Mortality: Epidemiology Strikes Again" by Dr. John R. Balmes (UCSF)

Vilcassim MJ, Thurston GD, **Lim CC**, Saunders E, Yao Y, Chen LC, Gordon T. "Health effects of traveling abroad: Impact on cardiopulmonary health due to exposure to greater air pollution levels." *Journal of Travel Medicine* 26(5) (2019)

Vilcassim MJR, Thurston GD, LC Chen, **Lim CC**, Gordon T. "Exposure to Greater Air Pollution when traveling abroad is associated with decreased lung function." *American Journal of Respiratory and Critical Care Medicine*, 199(12):1570-1572 (2019)

**Lim CC\***, Hayes RB, Ahn JY, Shao Y, Silverman DT, Jones RR, Thurston GD. "Mediterranean Diet and the Association between Air Pollution and Cardiovascular Disease Mortality Risk" *Circulation* 139(15):1766-1775 (2019)

With press coverage in Time Magazine, Yahoo News, DailyMirror, Mirror UK, Dr. Radio (podcast), and others

Caplin A, Ghandehari M, **Lim CC**, Thurston GD. "Health Wealth and Pollution: Advancing Exposure Assessment Science to Benefit Society." *Nature Communications* 10 (1), 1-11 (2019)

# Ashley A. Lowe, PhD, MSPH

## Ex. 6 Personal Privacy (PP)

### PROFESSIONAL SUMMARY

Dr. Lowe is a Behavioral Scientist with 7-plus years experience leading NIH-funded and CDC-funded clinical trials in pulmonary medicine and public health. Her experience includes implementation of evidence-based interventions in school-based and community settings. She has excellent oral and written communication skills and extensive experience presenting scientific findings among clinical, scientific and lay audiences. She has proven leadership skills with managing and building successful teams.

As a mix-methods researcher, she has expertise in all aspects of the research process for both clinical and implementation research. Her expertise includes: scientific writing and grantsmanship, study design, team building, participant recruitment, data collection, statistical analyses, dissemination and sustainability. Ashley leverages her quantitative skills using regression, and multivariate methods such as linear function analysis and discrete choice experiment. She also has extensive skills using qualitative methods by leading focus group discussions, semi-structured and one-on-one interviews. Dr. Lowe enjoys mentoring students, leading teams and engaging with both community stakeholders and industry leaders to improve health outcomes.

### SKILLS & PROFICIENCIES

- Stata / R
- Tableau / SQL
- Esri / ArcGIS Pro / ArcMap
- Orange
- REDCap
- ATLAS.ti

### PUBLICATIONS

<https://www.ncbi.nlm.nih.gov/myncbi/ashley.lowe.1/bibliography/public/>

### PROFESSIONAL RESEARCH EXPERIENCE

**Instructor** (*January 2022 to present*)

**Mel and Enid Zuckerman College of Public Health**  
Instructor for HPS 481: Health Education Intervention Methods.

**Post-doctoral Associate I** (*May 2021 to Present*)

**Asthma & Airway Disease Research Center**

Oversees an NIH-funded collaboration with the Navajo Nation to reduce asthma disparities among Navajo children. Engages with local, state and national leaders to pass stock medication legislation for schools across the United States. Conducts data analyses for scientific dissemination and prepares and presents scientific manuscripts for publication.

**Program Manager** (*May 2017 to Present*)

**Asthma & Airway Disease Research Center**

Manages the implementation of an evidenced-based, rescue medication program in 250-plus K-12 schools in Pima County, Arizona reaching 86% of county schools. Trains over 2,500-plus school personnel on stock rescue medication administration and program tasks. Duties include designing a toolkit to improve program adoption, implementation, maintenance & expansion in Arizona and across the United States.

**Senior Research Specialist** (*May 2017 to June 2021*)

**Asthma & Airway Disease Research Center**

Developed and implemented multi-site NIH clinical trials for the Clinical Research Unit (CRU). Authored complex literature reviews; analyzed & critically evaluated data; developed research protocols, standard operating procedures, scientific grants, presentations & manuscripts.

**Research Technician** (*October 2015 to May 2017*)

**Asthma & Airway Disease Research Center**

Assisted in the development of research protocols, grants & manuscripts.

# Ashley A. Lowe, PhD, MSPH

## RESEARCH SUPPORT

08/19/2021 – Present

Inventorying barriers to Covid-19 intervention implementation and risk perceptions among elementary school teachers. This is a cross-sectional, mixed methods descriptive survey study of 200 elementary school teacher participants in Tucson, Arizona to understand the barriers and facilitators of Covid-19 mitigation strategies in K-12 schools.  
Lowe A./ Wilson A. (Co-P.I.s)

National Institutes of Occupational Safety and Health (NIOSH)

Role: Co-P.I.

08/01/2021 – Present

Arizona Healthcare, Emergency Response, and Other Essential Workers Surveillance (AZ HEROES) Study is a prospective cohort to evaluate the immunogenicity and effectiveness of the Covid-19 vaccines among previously infected and uninfected essential and frontline workers in a US state or region (75D301-21-C-10970).

Burgess J. (P.I.)

Centers for Disease Control and Prevention (CDC)

Role: Pediatric Recruitment Consultant

2021 – Present

Child Informed Life Decisions (CHILD) Study: A

Discrete choice experiment

\$161,111 grant-funded study to investigate vaccine hesitancy related to uptake of the HPV vaccine in Pima County, Arizona

Madhivanan P. (P.I.)

Merck & Company

Role: Co-investigator

2021 – Present

Application of Sensor Systems to Examine the Exposure-Response Relationship between Air Pollution and Asthma Symptoms in Schools.

Lim C. (P.I.)

Grant-funded program to study air pollution and asthma outcomes among students in multiple Tucson schools.

Role: Consultant

## RESEARCH SUPPORT CONTINUED

2020 – Present

Robert Wood Johnson Foundation

P.I.'s Thakur, Neeta; Handley, Margaret; Grace, Rachel Willard

Site P.I. Gerald, LB

Covid-19 U.S. Resources and protections for vulnerable and high-risk communities (RESOUCES) Study

Role: Program Manager

2018 – Present

\$75,000 donation-funded program by Banner University Medical Center-Tucson

Program Director: Gerald, Lynn B.

The Pima County Stock Inhaler for Schools Program

Role: Program Manager

2017.08.15 – Present

\$7,144,476 grant-funded program by the National Institutes of Health, National Heart, Lung and Blood Institute

Bender, Bruce and Gerald, Lynn B. (P.I.s)

An Asthma Collaboration to Reduce Childhood Asthma Disparities on the Navajo Nation

Role: Research Assistant

## EDUCATION

### University of Arizona - Tucson

Asthma & Airway Disease Research Center

Post-doctoral Associate I (Current)

### University of Arizona - Tucson

PhD Health Behavior Health Promotion (2021)

Minor: Applied statistics

### University of Arizona - Tucson

Master of Science in Public Health (2018)

### University of Arizona - Tucson

Bachelor of Science in Public Health (2015)

*Magna Cum Laude*

**Michael A. Draper**

**Ex. 6 Personal Privacy (PP)**

**CAREER SUMMARY:** Possesses successful background in maintenance, installation and troubleshooting of manufacturing, air pollution monitoring, gravimetric analysis and data processing equipment. Possesses knowledge and in-depth experience in the air pollution monitoring field and related EPA regulations. Demonstrates strong interpersonal skills, leadership and communication.

**EDUCATIONAL STUDIES:** A.A. Degree, Electronics Communications – Mitchell Vocational Technical School, Mitchell, South Dakota.

**PROFESSIONAL BACKGROUND:**

**2014 - Present:** Monitoring Supervisor (Program Manager)  
Pima County Department of Environmental Quality

Responsible for the supervision, training and oversight of all personnel performing field activities related to air pollution monitoring. Ensures that all activities are performed in accordance with Departmental procedures and EPA requirements. Responsibilities also include performance evaluations/appraisals, disciplinary actions, procurement activities, communication with EPA Region 9 concerning monitoring network questions/concerns, participating in annual Network Assessment reports, reviewing departmental Quality Management and Quality Assurance Program Plans.

**2005 – 2014:** Quality Assurance Program Coordinator  
Pima County Department of Environmental Quality

Successfully performed QC/QA procedures according to departmental Standard Operating Procedures and 40 CFR 50 and 58. Updated existing/created new Standard Operating Procedures, Quality Management Plans and Quality Assurance Program Plans for all air monitoring equipment in addition to developing Standard Operating Procedures for the operation of the air monitoring gravimetric laboratory in accordance with 40 CFR 58 and the Quality Assurance Handbook 2.12. Developed new excel spreadsheets utilizing EPA formulas for instrument calibration, precision and bias, and coefficient of variation calculations. Ensured all field and laboratory operations were in accordance with departmental procedures and EPA regulations. Supervised Principle and Senior Instrumentation technicians in the operation of the gravimetric laboratory.

**2001 – 2005** Sr. Instrumentation Technician  
Pima County Department of Environmental Quality

Proficient in the installation, operation and maintenance of air monitoring equipment and new shelters for the purpose of air monitoring. Performed weekly, monthly, quarterly and annual quality control checks/procedures on criteria pollutant analyzers according to department quality control procedures and EPA regulations. Set up gravimetric laboratory according to EPA guidance.

**1989-2001:** Production Manager  
Tostino Coffee Roasters

Supervised departmental employees through yearly company growth and maintained/upgraded production and communication equipment. Was responsible for all production scheduling for each department, raw material orders, inventory, shipping/receiving, maintenance and training. Participated in new product research and development.

**1987-1989:** Installation Technician  
4-Tran Industries

Traveled throughout the United States and Mexico installing sound, lighting and video systems in residential homes and entertainment establishments. Was responsible for assemble and troubleshooting of multi-channel light systems power packs and laser assembly, alignment and troubleshooting.

**1985-1987:** Studio Engineer/Work Study Program  
KRNL Cable Channel 16, Mitchell SD

Responsible for broadcast and monitoring of pre-taped and live coverage of educational and high school activities. Maintained equipment and reconstruction of studio broadcast room.

#### **MILITARY SERVICE:**

**1982-1995:** Army National Guard  
Rank/Position: SSG/Platoon Sergeant

Responsible for the supervision, training and well-being of 45 personnel and equipment as well as the maintenance of multi-million-dollar equipment. Served distinguishably during Operation Desert Storm in theater.

#### **MILITARY EDUCATION:**

Completed over 300 hours of courses on leadership, counseling and decision making, along with interpersonal ethics, morals and values.

Awarded numerous citations for distinguished service, extraordinary performance, and certificates of appreciation for volunteer work.

## Other Attachment File(s)

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\* Mandatory Other Attachment Filename:

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To add more "Other Attachment" attachments, please use the attachment buttons below.

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Delete Optional Other Attachment

View Optional Other Attachment





THE UNIVERSITY OF ARIZONA

**Mel & Enid Zuckerman  
College of Public Health**

Roy P Drachman Hall  
1295 N Martin Avenue  
P.O. Box 245210  
Tucson, AZ 85724-5210  
Tel: (520) 626-3589  
Fax: (520) 626-8009

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Community, Environment and Policy Department

Natalie Shepp  
Pima County Department of Environmental Quality  
Bank of America Plaza  
33 N Stone Ave #700  
Tucson, Arizona, 85701

Dear Ms. Shepp,

I welcome the opportunity to collaborate with you on the EPA Enhanced Air Quality Monitoring for Communities grant entitled "Expanding Localized Air Quality Monitoring at Pima County Schools to Address Environmental Justice". In this proposed work, I will serve as a subaward principal investigator at the University of Arizona.

Our team will be responsible for modeling air pollution levels and creating an online platform to visualize and download air quality data, along with aiding with sensor collocation and calibration methods. We will also develop and lead educational modules to teach students about the potential health effects of air pollution during this project.

We have experience in sensor development and application in both research and environmental justice-based citizen science. Our expertise in air pollution modeling and exposure assessment, along with our close relationship and history of productive collaborations with various Pima County school districts, will allow us to carry out the work proposed here.

I look forward to working with you on this project and please do not hesitate to contact me for more information.

March 15, 2022

Chris C. Lim

Assistant Professor

Department of Community, Environment, and Policy  
Mel & Enid Zuckerman College of Public Health

The University of Arizona

[chrislim@arizona.edu](mailto:chrislim@arizona.edu)



A<sup>2</sup>DRC

1501 N. Campbell Avenue  
Rm. 2351-B PO Box 245030  
Tucson, AZ 85724-5030

Ofc: 520-626-8814  
Fax: 520-626-6623

March 23<sup>rd</sup>, 2022

Natalie Shepp  
Pima County Department of Environmental Quality  
Bank of America Plaza  
33 N Stone Ave #700  
Tucson, Arizona, 85701

Re: Letter of Support for Natalie Shepp

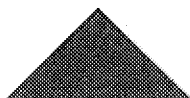
Dear Ms. Shepp:

I am writing to pledge my enthusiastic support for the proposed collaboration, "Expanding Localized Air Quality Monitoring at Pima County Schools to Address Environmental Justice", an Environmental Protection Agency's (EPA) opportunity. For this proposed project, I will serve as a subaward principal investigator (P.I.) at the University of Arizona's Asthma & Airway Disease Research Center (A2DRC).

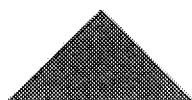
Our team at the A2DRC will work as the primary liaison between the program collaborators (PDEQ, MEZCOPH and SWEHSC) and the 178 public schools across 7 public school districts located in Pima County, Arizona. Our team will work with these schools to obtain school district permission, identify the 30 schools in which air monitoring sensors will be placed and the 7 high schools that will implement an educational curriculum. We will also work in partnership with program collaborators and the 7 school districts and their teachers to develop the educational curriculum together. Once the educational component is created, my team will work with SWEHSC and participating high schools to implement the program across 7 high schools. Lastly, we will be responsible for adapting the educational curriculum to a downloadable toolkit equipped with a step-by-step tutorial for future use by Pima County Schools that will be housed on Pima County Department of Environmental Quality's (PDEQ) website.

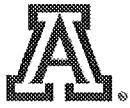
I look forward to our collaboration and please do not hesitate to contact me with any questions.

Warmly,



Ashley A. Lowe, PhD, MSPH  
Asthma & Airway Disease Research Center  
1501 N. Campbell Ave.  
Box 245030  
Tucson, Arizona 85724  
Ph: (520) 626-8814  
E-mail: [aaray@email.arizona.edu](mailto:aaray@email.arizona.edu)





THE UNIVERSITY OF ARIZONA

**Mel & Enid Zuckerman  
College of Public Health**

Roy P Drachman Hall  
1295 N Martin Avenue  
P.O. Box 245210  
Tucson, AZ 85724-5210  
Tel: (520) 626-4912  
Fax: (520) 626-8009

Department of Community, Environment and Policy

March 1<sup>st</sup>, 2022

RE: Letter of Support

Chris Lim, PhD, MS

Ashley A. Lowe, PhD, MSPH

Natalie Shepp, MPH

Dear EPA Grant Reviewers,

As the Director of the Community Engagement Core for the Southwest Environmental Health Sciences Center (SWEHSC), I am writing this letter of support for Drs. Chris Lim and Ashley Lowe (University of Arizona) and Ms. Natalie Shepp (Pima County Department of Environmental Quality (PDEQ)). Because Dr. Lim is a member of our core center, we enthusiastically support his proposed project entitled, "Expanding Localized Air Quality Monitoring at Pima County Schools to Address Environmental Justice." This project aligns well with our mission to facilitate and implement innovative work aimed at understanding the mechanisms of human disease risks due to environmental exposures among populations and to engage with communities, educators and public health professionals to understand these findings.

Drs. Lim and Lowe and Ms. Shepp's team propose a collaboration between the University of Arizona, PDEQ and SWEHSC to install a network of 30 air sensors in Pima County Schools. The project team intends to involve students in the data collection and analysis of this project. To accomplish this goal, SWEHSC will collaborate with their team to provide additional resources to this project. SWEHSC is a core center (NIH P30) that supports environmental health research through various resources and cores available to our members. Under the SWEHSC Community Engagement Core, led by myself, I pledge my support and resources to this project. I also co-lead the Implementation Resource for Translational and Human Exposure Research (IRTH) for SWEHSC, that assists researchers with study design, development of study protocols, and training for community research staff. We will work with Drs. Lim and Lowe and Ms. Shepp to create a student-led data collection and analysis project. This project will work with high schoolers from participating high schools to examine and interpret the data obtained from these air quality monitors and to develop an educational module on the impacts of air pollution for all Pima County Schools.

We are excited to collaborate on this project. If you have any questions regarding my support for this project, please contact me.

Best regards,

Paloma Beamer, PhD

Director, Community Engagement Core, Southwest Environmental Health Sciences Center

Professor, Environmental Health Sciences, College of Public Health



The University of Arizona  
Health Sciences

Tucson Campus  
Roy P. Drachman Hall, B207  
1295 North Martin Avenue  
P.O. Box 210202  
Tucson, AZ 85721-0202

Phoenix Campus  
550 East Van Buren Street  
Phoenix, AZ 85004-2330

Ofc: 520-626-1197  
Fax: 520-626-1460  
uahs.arizona.edu

OFFICE OF THE SENIOR VICE PRESIDENT  
FOR HEALTH SCIENCES

March 18, 2022

Natalie Shepp  
Public Outreach & Education Manager, Media Contact  
Pima County Department of Environmental Quality's  
33 N. Stone Ave., Suite 700  
Tucson, AZ 85701

**Subject:** Letter of Commitment from the University of Arizona  
**Prime Institution:** Pima County Department of Environmental Quality  
**FOA Title/Number:**  
**Project Dates:** 09/01/2022-08/31/2025

This letter is to confirm that the University of Arizona agrees to participate in the Pima County Department of Environmental Quality's project entitled "Expanding Localized Air Quality Monitoring at Pima County Schools to Address Environmental Justice."

We are pleased to be a part of this exciting project and are prepared to enter into the necessary inter-institutional consortium agreement(s) consistent with the prime award when the application is funded. Our institution's Federal Employer's Identification Number is 17-42652689A1; and our DUNS Number is 806345617. The University of Arizona's Cognizant Audit Agency is the Department of Health and Human Services, and our audited financial statements can be found here: <https://gao.az.gov/financials/single-audit>.

The Principal Investigator for the University of Arizona is Dr. Chris Lim. The total cost for The University of Arizona over the 3-year project period will be \$230,334. This includes facilities and administrative costs at the federally negotiated rate of 26% for off-campus other sponsored activity.

Please email administrative or budget questions to [sponsor@email.arizona.edu](mailto:sponsor@email.arizona.edu), referencing **UAR # 885691**. Award information should reflect the recipient as "Arizona Board of Regents, University of Arizona" and be sent to [sponsor@email.arizona.edu](mailto:sponsor@email.arizona.edu).

Your consideration of this application is appreciated.

Sincerely,

Digitally signed by Alexis Bantel  
Date: 2022.03.18 11:48:36 -07'00'

For: Sangita Pawar, PhD, MBA  
Vice President, Operations  
Research, Innovation and Impact  
University of Arizona  
PO Box 210158, Rm 510  
Tucson, AZ 85721-0158  
520 626 6000



February 15, 2022

**Re: Letter of Support for *Expanding Localized Air Quality Monitoring at Pima County Schools to Address Environmental Justice***

A school-based approach to air quality monitoring for Pima County, Arizona

Ashley A. Lowe, PhD, MSPH

Chris Lim, PhD, MS

Natalie Shepp, MPH

Dear Reviewers,

I am writing this letter of support for Drs. Ashley Lowe and Chris Lim and Ms. Natalie Shepp in regards to their collaboration entitled, "*Expanding Localized Air Quality Monitoring at Pima County Schools to Address Environmental Justice*". Dr. Lowe has a long-standing relationship with over 250 schools across Pima County, Arizona and she has worked with the Pima County Health Department (PCHD) for several years to implement the Pima County Stock Inhaler for Schools Program. The Stock Inhaler for Schools Program is a school-based program that increases access to rescue medication (albuterol sulfate) for school children. Her work with implementing this program has laid a foundation for improving the respiratory health of school children across Pima County.

PCHD was recently selected as one of four participating local health departments in the U.S. on the EPA's **Schools as Community Cleaner Air and Cooling Centers** initiative. The purpose of this initiative is to address extreme heat and air quality issues by developing community and school based cleaner air and neighborhood cooling refuges for vulnerable communities. Our existing efforts have highlighted the need for improved monitoring to better understand Pima County's air quality, ultimately to improve health outcomes for children with asthma and other conditions. Given many of our schools are located in environmentally and socially stressed communities, often where there are no existing air monitoring sensors, we strive to improve monitoring for school children.

Drs. Chris Lim and Ashley Lowe (University of Arizona), Ms. Natalie Shepp (Pima County Department of Environmental Quality) propose the following objectives:

- 1) Establish a network of low-cost sensors that measure particulate matter in Pima County Schools;
- 2) Implement, maintain and collect data from the air monitoring sensors;
- 3) Develop a science education plan for participating schools; and
- 4) Share data with Pima County Schools and the general public.

---

Theresa Cullen, MD, MS, Director

3950 S. Country Club Road, Suite 100, Tucson, AZ 85714 • Phone: 520-724-7765 • Fax: 520-838-7420

Reviewers

**Re: LOS: *Expanding Localized Air Quality Monitoring at Pima County Schools to Address Environmental Justice***

February 15, 2022

Page 2 of 2

Air sensors will be deployed and operated among schools located in environmentally stressed communities. The sensors will be capable of monitoring PM<sub>2.5</sub>, PM<sub>10</sub>, O<sub>3</sub>, and NO<sub>2</sub>. Drs. Lowe and Lim (University of Arizona) and Ms. Shepp (Pima County Department of Environmental Quality) will lead this program over the course of three years. Their team will partner with my team and the University of Arizona Southwest Environmental Health Sciences Center (SWEHSC) to mentor, teach and collaborate with K-12 students and school personnel. Students will be involved in the research to understand the data obtained from these monitors and to develop education modules pertaining to air pollution and health-related effects. If funded, the PCHD will enthusiastically support this collaboration and I am willing to offer guidance to the project. PCHD has worked closely with the schools throughout Pima County, and has implemented a public health team that is focused on improving the health status of youth. PCHD engagement with this current proposal will help accelerate our ability to positively impact engagement with the schools throughout our county. Please reach out with any questions or concerns regarding my support for this research study.

Sincerely,



Theresa Cullen, MD, MS  
Public Health Director  
RADM, USPHS (retired)  
Pima County Health Department



**Dustin J. Williams**  
Superintendent of Schools

Deborah Bryson  
Chief Deputy Superintendent

520.724.8451  
schools.pima.gov

February 15, 2022

RE: Letter of Support for *Expanding Localized Air Quality Monitoring at Pima County Schools to Address Environmental Justice*

A school-based approach to air quality monitoring for Pima County, Arizona

Ashley A. Lowe, PhD, MSPH

Chris Lim, PhD, MS

Natalie Shepp, MPH

Dear Reviewers,

I am writing this letter of support for Drs. Ashley Lowe and Chris Lim and Ms. Natalie Shepp in regards to their collaboration entitled, “*Expanding Localized Air Quality Monitoring at Pima County Schools to Address Environmental Justice*”. Dr. Lowe has a long-standing relationship with over 250 schools across Pima County, Arizona and she has worked with my office over the past six years to conduct outreach to schools regarding the Stock Inhaler for Schools Program. The Stock Inhaler for Schools Program is a school-based program that increases access to rescue medication (albuterol sulfate) for school children. Her work with implementing this program has laid a foundation for improving the respiratory health of school children across Pima County.

Because respiratory health also requires access to clean air, understanding the air quality surrounding Pima County schools remains important. The relationship between poor asthma outcomes and air pollution is well-established. One way to improve air quality in the school environment is to monitor the air quality in real-time. Dr. Chris Lim and Ms. Natalie Shepp are working in collaboration with Dr. Lowe to implement a school-based air monitoring system in Pima County Schools. This collaboration will provide schools with increased air quality monitoring equipment, maintenance of new equipment, and an opportunity for school children to become involved with learning the scientific approach behind data collection, visualization and air quality monitoring.

Their team proposes establishing a network of low-cost sensors measuring particulate matter in Pima County Schools. Air sensors will be deployed and operated among schools located in environmentally stressed communities. Additional monitors will be placed at schools to ensure a wide geographic area of monitoring equipment. The sensors will be capable of monitoring PM<sub>2.5</sub>, PM<sub>10</sub>, O<sub>3</sub>, and NO<sub>2</sub>. Drs. Lowe and Lim (University of Arizona) will work with Ms. Shepp’s office (Pima County Department of Environmental Quality) to implement the program for 3 years. Further, Drs. Lowe and Lim will work Ms. Shepp’s office to develop a science education





**Dustin J. Williams**  
Superintendent of Schools

Deborah Bryson  
Chief Deputy Superintendent

520.724.8451  
[schools.pima.gov](http://schools.pima.gov)

plan for participating schools. The research team will partner with Pima County Health Department and the University of Arizona Southwest Environmental

Health Sciences Center (SWEHSC) to mentor, teach and collaborate with students. K-12 students will be involved in the data collection and visualization process to understand the data obtained from these monitors and to develop education modules pertaining to air pollution and health-related effects. Lastly, these data will be shared with the schools and the public.

The insights achieved from this program will have a lasting impact on Pima County Schools. If funded, I will enthusiastically support this collaboration. Please reach out with any questions or concern regarding my support for this research study.

Sincerely,

Dustin J. Williams  
Pima County School Superintendent



Student Services Department  
2238 East Ginter Road  
Tucson, Arizona 85706  
(520) 545-2065  
(520) 545-2165

February 22, 2022

RE: Letter of Support

Ashley A. Lowe, PhD, MSPH

Chris Lim, PhD, MS

Natalie Shepp, MPH

Dear Reviewers,

On behalf of the Sunnyside Unified School District (SUSD), I am writing this Letter of Support of Drs. Ashley Lowe and Chris Lim (University of Arizona) and Ms. Natalie Shepp (Pima County Department of Environmental Quality). Dr. Lowe has worked with the SUSD for over seven years on various research initiatives. One such project included the implementation of a district-wide stock medication program for children with asthma. It is the intention of the Sunnyside Unified School District (SUSD) to support a new project entitled, *"Expanding Localized Air Quality Monitoring at Pima County Schools to Address Environmental Justice."*

Drs. Lowe, Lim and Ms. Shepp's team proposes a network of air sensors across Pima County, Arizona, to monitor PM<sub>2.5</sub>, PM<sub>10</sub>, O<sub>3</sub>, and NO<sub>2</sub>. **With support from the Pima County Superintendent's Office (Superintendent Dustin Williams)**, the research team will deploy monitors in charter, private/parochial and public schools. A special emphasis will be placed on environmentally stressed communities. The Sunnyside Unified School District is located in the industrial parts of Tucson, where several schools border or are located in close proximity to the Tucson International Airport. These areas are known to experience high levels of air pollution. We intend to support this project to understand how our schools are impacted by poor air quality. The research team further intends to mentor, teach and collaborate with K-12 students and school personnel. Students will be involved in the research to understand the data obtained from these monitors and to develop education modules pertaining to air pollution and health-related effects. The long-term goal of this research project is to improve our knowledge surrounding the impact of air pollution among environmentally stressed communities and to increase the knowledge of the research process among students. Our district is excited to support this program and to participate in this science initiative.

Please reach out with any questions or concerns regarding our support for this research study.

Sincerely,

A handwritten signature in dark ink, appearing to read "J. Gastelum".

Jose Gastélum, M.Ed.  
Chief Student Services Officer  
2238 East Ginter Road  
Tucson, Arizona 85706



# Flowing Wells Unified School District

*Potential Finds Opportunity*

IOLA FRANS ADMINISTRATION CENTER  
1556 W. PRINCE ROAD  
TUCSON, ARIZONA 85705-3087  
(520) 696-8000 | FAX: (520) 690-2400

February 15th, 2022

RE: Letter of Support

Ashley A. Lowe, PhD, MSPH

Chris Lim, PhD, MS

Natalie Shepp, MPH

Dear Reviewers:

I am writing this Letter of Support on behalf of Drs. Ashley Lowe and Chris Lim (University of Arizona) and Ms. Natalie Shepp (Pima County Department of Environmental Quality). Dr. Lowe has a long-standing partnership with the Flowing Wells Unified School District (FWUSD). Dr. Lowe has worked with District Nurse Administrator, Alicia Larson, and her predecessor, Barbara "Babs" Greenbaum to implement the Pima County Stock Inhaler for Schools program in the Flowing Wells Unified School District. This partnership has been maintained for six consecutive years. It is our intention to support a new research project entitled, *"Expanding Localized Air Quality Monitoring at Pima County Schools to Address Environmental Justice."*

Their team proposes a network of air sensors across Pima County, Arizona, to monitor PM<sub>2.5</sub>, PM<sub>10</sub>, O<sub>3</sub>, and NO<sub>2</sub>. With support from the Pima County Superintendent's Office (Superintendent Dustin Williams), the research team will deploy monitors in charter, private/parochial and public schools. A special emphasis will be placed on environmentally stressed communities. Because the FWUSD has many schools located near busy roadways and close to the main freeway that passes through Tucson, many students experience the impact of air pollution from these sources. Further, our Flowing Wells families and schools experience additional environment stressors including exposure to nearby industrial sources of pollution. For this reason, our district enthusiastically supports this project.

Drs. Lowe and Lim and Ms. Shepp propose a partnership with the University of Arizona Southwest Environmental Health Sciences Center (SWEHSC) and Pima County Health Department (PCHD) to mentor, teach and collaborate with FWUSD K-12 students and school personnel. FWUSD students will be involved in the research to understand the data obtained from these monitors and to develop education modules pertaining to air pollution and health-related effects. The long-term goal of this research project is to improve our knowledge surrounding the impact of air pollution among environmental stressed communities and to increase the knowledge of the research process among students.

The objective of this study fits well with FWUSD's mission and vision of exceptional educational opportunities and high expectations for achievement as community learners. Through improving the health of all children, including children from different backgrounds and belief systems, we can improve our knowledge on the effects of air pollution. The information collected from this project will ultimately inform schools, researchers, and governmental bodies regarding the impact of air pollution among Pima County Schools and prepare students to participate in local science initiatives.

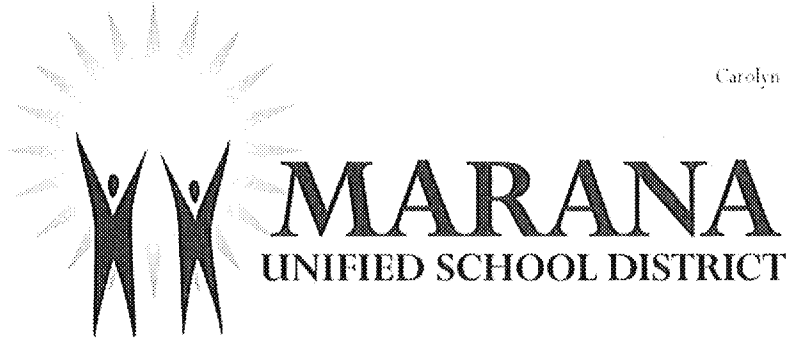
Please reach out with any question or concerns regarding our support for this research study.

Sincerely,

Dr. Audrey Reff  
Assistant Superintendent  
Flowing Wells Unified School District

## GOVERNING BOARD

Maribel Lopez, Ed.D., President  
John Lewandowski, Vice President  
Tom Carlson, Member  
Hunter Holt, Member  
Dan Post, Member



## ADMINISTRATION

Daniel Streeter, Ed.D., Superintendent  
Carolyn Dumluer, Ed.D., Assistant Superintendent  
Kristin Reidy, Assistant Superintendent  
Dan Contorno, Chief Financial Officer

March 9, 2022

RE: Letter of Support

Ashley A. Lowe, PhD, MSPH  
Chris Lim, PhD, MS  
Natalie Shepp, MPH

To the Reviewing Committee:

I am writing this Letter of Support on behalf of Drs. Ashley Lowe and Chris Lim (University of Arizona) and Ms. Natalie Shepp (Pima County Department of Environmental Quality). Dr. Lowe has a long-standing partnership with the Marana Unified School District (MUSD). Dr. Lowe has worked with District Nurse Administrator, Nicole Pargas, for several years, and her predecessor, Judie Crawford. During this relationship, Dr. Lowe worked with Judie and then Nicole to implement a district-wide Stock Inhaler for Schools Program. The program increases access to rescue medication (albuterol sulfate) for children who experience respiratory distress. This partnership has been maintained for six years. It is our intention to support a new research study entitled, *"Expanding Localized Air Quality Monitoring at Pima County Schools to Address Environmental Justice."*

Their team proposes a network of air sensors across Pima County, Arizona, to monitor PM<sub>2.5</sub>, PM<sub>10</sub>, O<sub>3</sub>, and NO<sub>2</sub>. With support from the Pima County Superintendent's Office (Superintendent Dustin Williams), the research team will deploy monitors in charter, private/parochial and public schools. A special emphasis will be placed on environmentally stressed communities. Given schools in the MUSD are geographically located in areas that experience high levels of air pollution, including exposures to the I-10 Freeway and dust produced by nearby agricultural, we enthusiastically support increased air quality monitoring. In addition to the air sensors, the research team will partner with the University of Arizona Southwest Environmental Health Sciences Center (SWEHSC) to mentor, teach and collaborate with MUSD K-12 students and school personnel. Students will be involved in the research to understand the data obtained from these monitors and to develop education modules pertaining to air pollution and health-related effects. The long-term goal of this research project is to improve our knowledge surrounding the impact of air pollution among environmental stressed communities and to increase the knowledge of the research process among students.

The objective of this study fits well with MUSD's vision to inspire students to learn today and lead tomorrow. Through improving the health of all children, including children from different backgrounds and belief systems, we can improve our knowledge and public health response to issues within our local community. The information collected from this project will ultimately inform schools, researchers, and governmental bodies regarding the impact of air pollution among Pima County Schools and prepare students to participate in local science initiatives.

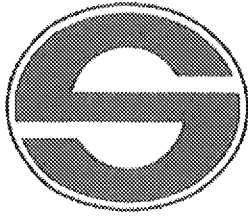
Please reach out with any question or concerns regarding our support for this research study.

Sincerely,



Dr. Daniel Streeter  
Superintendent

*Inspiring students to learn today and lead tomorrow.*



SAHUARITA UNIFIED SCHOOL DISTRICT #30

350 W. Sahuarita Road, Building 10

Sahuarita, AZ 85629-9000

Ph: (520) 625-3502 x1001

Fax: (520) 625-5380

Office of the Superintendent

March 11, 2022

RE: Letter of Support

Ashley A. Lowe, PhD, MSPH

Chris Lim, PhD, MS

Natalie Shepp, MPH

Dear Reviewers:

I am writing this Letter of Support on behalf of Drs. Ashley Lowe and Chris Lim (University of Arizona) and Ms. Natalie Shepp (Pima County Department of Environmental Quality). Dr. Lowe has worked with our **District Nurse, Jeanine Sarnacki** for over six years. During the 6 years of collaboration, Dr. Lowe and Jeanine worked together to implement a district-wide stock medication program for children with asthma. It our intention to support a new project entitled, *"Expanding Localized Air Quality Monitoring at Pima County Schools to Address Environmental Justice."*

Drs. Lowe, Lim and Ms. Shepp's team proposes a network of air sensors across Pima County, Arizona, to monitor PM<sub>2.5</sub>, PM<sub>10</sub>, O<sub>3</sub>, and NO<sub>2</sub>. **With support from the Pima County Superintendent's Office (Superintendent Dustin Williams)**, the research team will deploy monitors in charter, private/parochial and public schools. A special emphasis will be placed on environmentally stressed communities including communities disproportionately exposed to air pollution. Sahuarita Unified School District is located south of Tucson in Sahuarita, Arizona. Our community consists of mining and agricultural operations that produce significant forms of dust. The research team will also work with Sahuarita Unified School District to mentor, teach and collaborate with K-12 students and school personnel. Students will be involved in the research to understand the data obtained from these monitors and to develop education modules pertaining to air pollution and health-related effects. The long-term goal of this research project is to improve our knowledge surrounding the impact of air pollution among environmental stressed communities and to increase the knowledge of the research process among students. Our district is excited to support this program and to participate in this science initiative.

Please reach out with any question or concerns regarding our support for this research study.

Sincerely,

Manuel O. Valenzuela, Ed.D.  
Superintendent of Schools  
Sahuarita Unified School District



## Tanque Verde Unified School District #13

4201 N. Melpomene Way, Bldg. 10

Tucson, Arizona 85749

Phone: 520.749.5751 • Fax: 520.749.5400 • [www.tanqueverdeschools.org](http://www.tanqueverdeschools.org)

February 21st, 2022

RE: Letter of Support

Ashley A. Lowe, PhD, MSPH

Chris Lim, PhD, MS

Natalie Shepp, MPH

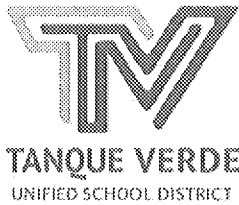
To the Reviewing Committee:

I am writing this Letter of Support on behalf of Drs. Ashley Lowe and Chris Lim (University of Arizona) and Ms. Natalie Shepp (Pima County Department of Environmental Quality). Dr. Lowe has worked with our District Health Team and District Nurse, Marie Baca, for over six years. During the 6 years of collaboration, Dr. Lowe and Nurse Baca worked together to implement a district-wide stock medication program for children with asthma. It is the intention of the Tanque Verde Unified School District (TVUSD) to support a new project entitled, *"Expanding Localized Air Quality Monitoring at Pima County Schools to Address Environmental Justice."*

Drs. Lowe, Lim and Ms. Shepp's team proposes a network of air sensors across Pima County, Arizona, to monitor PM<sub>2.5</sub>, PM<sub>10</sub>, O<sub>3</sub>, and NO<sub>2</sub>. With support from the Pima County Superintendent's Office (Superintendent Dustin Williams), the research team will deploy monitors in charter, private/parochial and public schools. Since Tanque Verde Unified School District is located in Northwest Tucson, participation of our schools is integral to understanding air quality around Tucson. While we do not have schools located next to busy highways, we do experience dust and exposures to PM<sub>2.5</sub>. These data will be important for understanding differences in air quality by school location. The research team further proposes to mentor, teach and collaborate with K-12 students and school personnel. Students will be involved in the research to understand the data obtained from these monitors and to develop education modules pertaining to air pollution and health-related effects. The long-term goal of this research project is to improve our knowledge surrounding the impact of air pollution among environmental stressed communities and to increase the knowledge of the research process among students. Our district is excited to support this program and to participate in this science initiative.

Please reach out with any question or concerns regarding our support for this research study.

Sincerely,



## Tanque Verde Unified School District #13

4201 N. Melpomene Way, Bldg. 10

Tucson, Arizona 85749

Phone: 520.749.5751 • Fax: 520.749.5400 • [www.tanqueverdeschools.org](http://www.tanqueverdeschools.org)

Scott Hagerman Ed.D

Superintendent

Tanque Verde Unified School District

# TUCSON UNIFIED SCHOOL DISTRICT

## Office of the Superintendent

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March 10, 2022

RE: Letter of Support  
Ashley A. Lowe, PhD, MSPH  
Chris Lim, PhD, MS  
Natalie Shepp, MPH

To the Reviewing Committee:

I am writing this Letter of Support on behalf of Drs. Ashley Lowe and Dr. Chris Lim (University of Arizona) and Ms. Natalie Shepp (Pima County Department of Environmental Quality). Dr. Lowe has worked with our District Health Team for over seven years. Dr. Lowe has worked with Nikki Stefan, Penny Cuffe, and Sharon Edwards to implement a district-wide stock medication program for children with asthma. It is the intention of the Tucson Unified School District (TUSD) to support a new project entitled, *"Expanding Localized Air Quality Monitoring at Pima County Schools to Address Environmental Justice."*

Drs. Lowe, Dr. Lim and Ms. Shepp's team proposes a network of air sensors across Pima County, Arizona, to monitor PM<sub>2.5</sub>, PM<sub>10</sub>, O<sub>3</sub>, and NO<sub>2</sub>. With support from the Pima County Schools Superintendent Dustin Williams' Office the research team will deploy monitors in charter, private/parochial and public schools. A special emphasis will be placed on environmentally stressed communities. TUSD has almost 90 school locations located across the Tucson Metropolitan area. Some of our schools are located next to busy streets and highways. We are interested in participating in this program to understand the air quality around our schools. The research team will also work with TUSD to mentor, teach and collaborate with K-12 students and school personnel. Students will be involved in the research to understand the data obtained from these monitors and to develop education modules pertaining to air pollution and health-related effects. The long-term goal of this research project is to improve our knowledge surrounding the impact of air pollution among environmental stressed communities and to increase the knowledge of the research process among students. Our district is excited to support this program and to participate in this science initiative.

Please reach out with any question or concerns regarding our support for this research study.

Respectfully,



Gabriel Trujillo, Ed.D.  
Superintendent

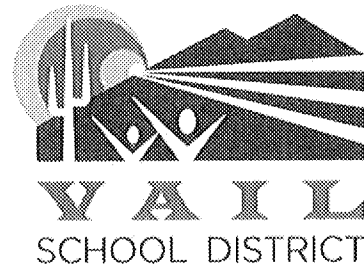
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1010 E. Tenth Street • Tucson, AZ 85719 • Phone: (520)225-6060 • Fax: (520)225-6174

### Governing Board

Ms. Adelita S. Grijalva, President; Ms. Natalie Luna Rose; Clerk, Ms. Leila Counts, Dr. Ravi Shah, Ms. Sadie Shaw





**OFFICE OF THE SUPERINTENDENT**

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13801 E Benson Highway • P.O. Box 800 • Vail, AZ 85641 • 520-879-2000 • FAX 520-879-2001

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March 4, 2022

To the Reviewing Committee:

I am honored to write a letter of support on behalf of Drs. Ashley Lowe and Chris Lim (University of Arizona) and Ms. Natalie Shepp (Pima County Department of Environmental Quality). Dr. Lowe has worked with our District Health Team and District Nurse, Christina Conte, for over six years. During the six years of collaboration, Dr. Lowe and Ms. Conte worked together to implement a district-wide stock medication program for children with asthma. We value our partnership with Dr. Lowe and would love to continue that relationship through a new project entitled, "Expanding Localized Air Quality Monitoring at Pima County Schools to Address Environmental Justice."

Drs. Lowe, Lim, and Ms. Shepp's team proposes a network of air sensors across Pima County, Arizona, to monitor PM2.5, PM10, O3, and NO2. A special emphasis will be placed on environmentally stressed communities. Vail is located in the outskirts of the Tucson area, but experiences high levels of dust and exposure to PM2.5. A few of our schools are even located in close proximity to the I-10 freeway.

We are thrilled to see our students become involved in the research to understand the data obtained from these monitors and to develop education modules pertaining to air pollution and health-related effects. They will learn the impact of air pollution and gain valuable researching skills from community professionals.

We are not only interested in participating for improved air quality and research opportunities for our children, but also to continue our valued partnership. Vail is a place "Where Education Is a Community Effort." This project reinforces that motto. Our district is excited to support this program and to participate in this science initiative.

Sincerely,

John Carruth  
Superintendent  
Vail Unified School District

*"Where Education is a Community Effort"*

web site address: [www.vailschooldistrict.org](http://www.vailschooldistrict.org) email: [carruthj@vailschooldistrict.org](mailto:carruthj@vailschooldistrict.org)

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